1992

AIR QUALITY DATA

FOR ARIZONA

Annual Report

Honorable Fife Symington
Governor
State of Arizona

Arizona Department of Environmental Quality
Edward Z. Fox, Director

The Arizona Department of Environmental Quality shall preserve, protect and enhance the environment and public health and shall be a leader in the development of public policy to maintain and improve the quality of Arizona's air, land and water resources.

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I. BACKGROUND

A. LEGAL AUTHORITY

Arizona derives its authority to regulate air quality from the Federal Clean Air Act and from State Statutes, both of which are described herein. The first Federal Clean Air Act was passed in 1963. It provided for grants to air pollution control agencies and contained the first federal regulatory authority. The Act was amended in 1965, 1967, 1970, 1977, and 1990. One important feature of the Act was the establishment of National Ambient Air Quality Standards (NAAQS) in 1970. These standards, which are promulgated by the EPA (Environmental Protection Agency), are set at levels which protect public health and welfare. A brief discussion of the standards is provided in the following subsection B, Air Quality Standards.

Another significant aspect of the Act is the requirement of the states to formulate plans to comply with the NAAQS. Specifically, Title I of the Act requires states to adopt and submit to EPA plans which provides for the implementation, maintenance and enforcement of air quality standards within a specific time after standard promulgation. This plan is referred to as the State Implementation Plan (SIP), which consists of several different elements. Some of the more important SIP components are listed below:

1. Rules, including enforceable emission limitations and other measures, necessary for attainment and maintenance of the standards.

2. Compliance schedules.

3. Ambient monitoring and data analysis.

4. A permitting program, including the requirement for preconstruction review and disapproval of new or modified sources which would interfere with the attainment or maintenance of air quality standards or would significantly deteriorate air quality.

5. Source surveillance.

6. Inspection and testing of vehicles.

7. Provisions to revise the plan.

8. Legal authority to carry out the SIP.

9. Prevention of air pollution emergency episodes.

Arizona's SIP contains State statutes and rules, county regulations and the nonattainment area plans required for attainment and maintenance of the NAAQS. These documents are transmitted by the Arizona Department of Environmental Quality (ADEQ) to EPA. EPA formally approves or disapproves the SIP revisions through Federal Register notices.

State statutes divide jurisdiction over air pollution sources between the State and the counties. The State has exclusive jurisdiction over air pollution sources having potential total emissions of 75 tons or more per day; air pollution sources owned or controlled by State or local government entities; motor vehicles;

and other mobile air pollution sources over which the State has asserted jurisdiction. All other sources come under county authority. Currently Maricopa, Pinal, and Pima Counties have established air quality control districts. It should be noted, however, that in other Counties which lack air quality control programs, the State has complete jurisdiction . These counties include Apache, Cochise, Coconino, Gila, Graham, Greenlee, La Paz, Mohave, Navajo, Yavapai, and Yuma.

In the Maricopa and Pima County nonattainment areas, the regional planning agencies are required to develop plans to show how the area will attain and maintain the NAAQS. The county and cities and towns in the area must adopt and implement the plan as expeditiously as practicable. For areas which are nonattainment with respect to carbon monoxide or ozone, the plan includes transportation control measures designed to reduce motor vehicle traffic, to alleviate traffic congestion, to promote the use of cleaner fuels, and other strategies. For areas not meeting particulate (PM_{10}) standards, control strategies such as paving of roads, restricting off-road vehicular traffic, suppressing fugitive dust at construction sites, and other measures are key elements of the plan.

With respect to nonattainment areas, the 1990 Clean Air Act changed several key provisions including:

- Criteria for classifying nonattainment areas;
- Classifications of nonattainment areas;
- Control measures required for each classification; and
- Deadlines for compliance with NAAQS.

Other major features of the 1990 Clean Air Act addressed the following issues:

- Mobile sources
- Air toxics
- Acid rain
- Permits
- Stratospheric ozone depletion
- Visibility Protection
- Enforcement and
- Miscellaneous Provisions.

B. AIR QUALITY STANDARDS

EPA has set NAAQS for six pollutants, which are summarized in Table 1. For each pollutant EPA has adopted primary standards to protect public health and secondary standards to protect public welfare. The states are required to adopt standards which are at least as stringent as the NAAQS. In Arizona, ambient air quality standards are identical to the federal NAAQS.

A brief summary of the health and welfare effects which have been considered prior to setting ambient air quality standards is given below.

Health and Welfare Effects (at ambient concentrations)

Pollutant	
Carbon Monoxide	Impairs the ability of blood to carry oxygen in the body. Cardiovascular system is primarily affected, causing angina pain in persons suffering from

	cardiac disease and leg pain in individuals with occlusive arterial disease. Affects other mammals in a similar manner.
Lead	Damages the cardiovascular, renal, and nervous systems resulting in anemia, brain damage, and kidney disease. Preschool age children are particularly susceptible to brain damage effects. Similar effects observed in other mammals. Other adverse effects on animals, microorganisms, and plants.
Nitrogen Dioxide	Impairs the respiratory system, causing a high incidence of acute respiratory diseases. Preschool children are especially at risk. Damages certain plants and materials. Degrades visibility due to its brownish color and its conversion to nitrate particles. Nitrate particles are also a major component of acid deposition.
Ozone	Damages the respiratory system, reducing breathing capacity and causing chest pain, headache, nasal congestion, and sore throat. Individuals with chronic respiratory diseases are especially susceptible to ozone. Injures certain plants, trees, and materials.
Particulates	Causes irritation and damage to the respiratory system, resulting in difficult breathing, inducement of bronchitis, and aggravation of existing respiratory diseases. Also, certain polycyclic aromatic hydrocarbons in particulate matter are carcinogenic. Individuals with respiratory and cardiovascular diseases, children, and elderly persons are at the greatest risk. Soils and damages materials. Impairs visibility. Particulates in acid deposition damage materials, plants, and trees and acidify surface waters, thereby harming aquatic life.
Sulfur Dioxide	Aggravates asthma, resulting in wheezing, shortness of breath, and coughing. Healthy persons exhibit the same responses at higher exposures. Asthmatics and atopic individuals are the most sensitive groups, followed by those suffering from bronchitis, persons with emphysema, bronchiectasis, cardiovascular disease, the elderly, and children. Damages certain plants and materials. Impairs visibility and contributes to acid deposition due to the its conversion to sulfate particles.

C. SOURCES

1. Carbon Monoxide (CO)

Motor vehicles are by far the major source of CO, followed by minor sources including aircraft, controlled forestry and agricultural burning, industrial facilities, fireplaces, structural fires, railroads and off-road vehicles. Because CO is emitted mainly at ground level, it is trapped at nighttime when the lower atmosphere is stagnant due to a surface-based temperature inversion. As a result, CO concentrations are much greater during evening and early morning hours. Surface-based temperature inversions occur after sunset due to the cooling of the earth's surface as it loses heat by radiation. After sunrise, solar radiation heats the earth's surface and the lower atmosphere, resulting in dissipation of the temperature inversion. Since inversions are

more severe during the fall and winter months, CO concentrations are much higher in these months. As a result, standards are exceeded primarily in the period from October through March. Exceedances of the CO standard occur in the Phoenix metropolitan area.

2. Lead (Pb)

Lead is emitted primarily by motor vehicles (not equipped with catalytic converters) which burn leaded gasoline. Both the use of leaded gasoline and the lead content of this fuel have decreased substantially. Ambient concentrations of lead have declined over time and are well below the standard in Phoenix and Tucson.

3. Nitrogen Dioxide (NO_2)

Motor vehicles are the dominant source of NO_2 emissions, followed by power plants, and industrial and commercial facilities. In addition, NO_2 is also derived from the oxidation of NO (nitric oxide) in the atmosphere. NO is emitted by the same sources that emit NO_2. Concentrations of NO_2 in Arizona are well below the ambient standard.

4. Ozone (O_3)

Ozone is formed in the atmosphere by the reaction of volatile hydrocarbons with nitrogen oxides (NO and NO_2). This chemical reaction occurs much faster in the presence of sunlight at higher temperatures. Thus, ozone concentrations are greater in the afternoon hours from May to September and occasionally exceed the standard in Phoenix. Days on which ozone concentrations are high are characterized by low wind speeds, late temperature inversion dissipation, and a relatively early wind direction shift. Hydrocarbons and nitrogen oxides, the precursors of ozone, are emitted largely by motor vehicles. Secondary sources of hydrocarbons include gasoline marketing, organic solvent usage, and miscellaneous area sources. For nitrogen oxides, secondary sources include power plants and industrial and commercial boilers.

5. Particulates (PM_{10})

Sources of particulate matter vary widely in Arizona by region and season. In Phoenix and Tucson, motor vehicles exhaust and resuspension of road dust by traffic are the two major sources. Minor sources include construction activity and windblown dust from disturbed desert. In agricultural areas, farming activity is an additional source of fugitive dust whereas fireplaces and wood stoves emit substantial quantities of smoke in northern Arizona. In rural, industrial areas of the state, tailings piles, surface mines, quarries, material handling and storage, ore crushing and grinding, and haul roads are sources of particulate matter. Exceedances of particulate standards in the State occur chiefly in the southern and western desert regions.

6. Sulfur Dioxide (SO_2)

In Arizona, major sources of SO_2 include copper smelters and coal-fired power plants which are located in rural areas with the exception of one coal-fired power plant in Tucson. Generally, SO_2 concentrations near power plants are well below the standards. In the copper smelter areas, however, concentrations have occasionally exceeded the standards, although no violations of the SO_2 NAAQS were recorded in Arizona in 1992.

II. PROGRAM ACTIVITY IN 1992

A. AMBIENT MONITORING/QUALITY ASSURANCE

The state monitoring network was expanded in 1992, most significantly by the addition of a centrally located site in Phoenix(4530 N.17th Ave.). A complete set of instruments for monitoring criteria pollutants was operated at this site with an automated data acquisition system. One special feature of this site is automatic, continuous monitoring of PM_{10} with an R&S Series 1400 TEOM sampler. Thus, the first continuous PM_{10} database for Phoenix was initiated at this location in 1992. In addition to conventional air quality surveillance, visibility monitoring is conducted at this location as part of the Phoenix Urban Haze Monitoring Network. A discussion of this network is given below in subsection C.

In southern Cochise County PM_{10} samplers were installed and operated at Bisbee Junction and Naco in 1992. The purpose of these sites is to assess the impact of emissions from a lime plant, a landfill, unpaved roads, and other sources in the Naco, Sonora area. Also, a PM_{10} monitor was put into operation at Somerton to determine background concentrations for the Yuma nonattainment area. In Yuma a sampler was colocated with the original sampler at the Yuma County Juvenile Center to provide additional quality assurance data.

In the Phoenix CO nonattainment area three monitoring stations were operated by ADEQ in conjunction with a modeling study performed by EPA to determine maximum concentrations. Site locations included Thomas Rd./Grand Ave./27th Ave., Sky Harbor International Airport, and 7th Ave./Osborn Rd. In addition, a fourth CO monitor was operated at the centrally located site at 4530 N.17th Ave. to monitor neighborhood scale concentrations. Consequently, two violations of the 8-hour standard were monitored at the Thomas Rd./Grand Ave./27th Ave. during the 92-93 fall/winter season. As a result, revision of the CO State Implementation Plan (SIP) for the Phoenix nonattainment area will be required because the deadline for attainment of the standard was not met.

During the summer of 1992 an O_3 monitoring study was performed in support of modeling and SIP development for the Phoenix nonattainment area (see subsection E. below for a discussion of the modeling study). Measurements of O_3 and its precursors (VOCs, NO_X, and Carbonyls) and meteorological parameters at ground and upper levels were taken throughout the Phoenix airshed. In addition, air quality and meteorological data were obtained from networks operated by the Maricopa County Division of Air Pollution, the Salt River Project, the National Weather Service, the University of Arizona, and the Volkswagen Proving Grounds.

B. TUCSON URBAN HAZE INTENSIVE STUDY

The Tucson Urban Haze Pilot Study of 1989-90 generally identified the scope and parameters of a subsequent full-scale intensive study, recommending multiple ambient sampling configurations and sites, Fall and Winter season sampling and emissions source testing specific to the Tucson metropolitan area in order to define the nature and causes of the most intense haze events. ENSR Consulting and Engineering, Inc. of Camarillo, California was retained to lead a team of contractors to conduct the 1992-93 Tucson Urban Haze Intensive Study, with the field sampling portion of the Study beginning November 16, 1992 and ending January 24, 1993. Gaseous pollutant data, particulate filter samples and optical measurements will be analyzed and computer simulations performed during the Spring and Summer, with the final urban haze source

apportionment report due in the Fall of 1993. Review and comment on the draft version of this report by officials from the City of Tucson, Pima County, Pima Association of Governments, University of Arizona and other local groups will be solicited in the preparation of the final report. The Tucson Urban Haze Intensive Study Final Report will provide light extinction coefficients for the emissions source species which impair visibility and create urban haze in the Tucson metropolitan area. These coefficients will be used to apportion the sources of future haze events.

C. PHOENIX AND TUCSON LONG-TERM URBAN HAZE MONITORING NETWORKS

In support of the 1992-93 Tucson Urban Haze Intensive Study and as recommended by 1989-90 Phoenix and Tucson Pilot Urban Haze and PM_{10} Intensive Studies, long-term joint urban haze and PM_{10} monitoring networks were established in the Tucson and Phoenix metropolitan areas. Throughout the Phoenix urban area, an ADEQ technician optically monitors urban visibility and collects filter samples of suspended particulate matter, the primary cause of haze in the Phoenix area. A Pima County Department of Environmental Quality technician funded by ADEQ began the operation of a similar network coincident with the 1992-93 ENSR Intensive Study. Data collected by the Tucson Long-Term Network during the Intensive Study will be used in the source apportionment analysis by ENSR, to lower the costs paid out on contract and test the components of the long-term network.

The Phoenix and Tucson Long-Term Urban Haze Monitoring Networks collect optical visual impairment data to define the quantity and magnitude of haze events in the urbanized areas on a year-round basis. These networks will track the trend of visibility impairment levels in each urban area over time to allow assessment of the success of pollution control strategies and technologies as they are implemented. The visibility-impairing fraction of PM_{10} is also evaluated for trends, with these new PM_{10} monitoring sites providing additional sampling data throughout the urban areas to supplement the present Maricopa and Pima Counties' monitoring networks. The PM_{10} samplers used in the Long-Term Networks are the same devices used to measure PM_{10} in areas around the state with existing unhealthy particulate concentration levels, thereby standardizing PM_{10} data collection methods across the state. Support services for quality assurance, laboratory analyses and operational support for these specialized monitoring networks have been implemented by ADEQ using private contractors.

D. AGRICULTURAL DUST CONTROL

ADEQ continues to sponsor projects,conducted in Marana and Yuma, investigating alternative methods of agricultural tillage to reduce particulate emissions. The goal of these projects is to quantify the reduction of particulate emissions by comparing emissions during conventional tillage and alternative tillage operations. Alternative tillage may be defined as tillage methods that reduce soil or water loss.

In typical alternative tillage scenarios, more than one farm operation is performed during a pass on a field. Fewer passes are performed and less dust is emitted. The alternative operation itself leaves the field in a condition that is less conducive to dust emissions from wind erosion. ADEQ funded the University of Arizona, Department of Agricultural and Biosystems Engineering, to conduct research with alternative tillage equipment to quantify particulate emissions levels. Preliminary results from 1990, 1991, and 1992 crop seasons indicate

reductions in dust emissions when alternative tillage is used. This research will continue through 1994 and a final publication will be available in 1995.

E. PHOENIX OZONE STUDY AND URBAN AIRSHED MODELING

The Phoenix area has been classified by the U.S. Environmental Protection Agency (EPA) as a "moderate" nonattainment area for Ozone (O_3). The 1990 Clear Air Act Amendments require states to submit complete O_3 SIPs by November 1993. With these objectives in mind, ADEQ prepared a document entitled Workplan for Development of the Phoenix Ozone SIP, March 1992. This workplan called for a modeling analysis to define the relationships between emissions of precursors and the formation of ozone. The most appropriate model for this purpose is the Urban Airshed Model (UAM) which requires an extensive air quality, meteorological, and emissions database. Part of this required database is available from air quality and meteorological networks routinely operated by various governmental and industrial organizations. However, certain elements of the required database are not routinely monitored. Consequently, ADEQ found it necessary to conduct a monitoring study to collect upper level meteorological and air quality data; VOC, carbonyl and NO_x air quality data; and background air quality data. In addition, the monitoring study included a quality assurance program to ensure that ADEQ and the Maricopa County Division of Air Pollution Control (MCDAPC) obtained reliable air quality data.

The primary study objectives were met in the summer and fall of 1992 with some deficiencies in both data collection and quality indicated. An adequate network of ground-based ozone monitors were operated in the Phoenix nonattainment area. In addition, one upper level ozone monitor, two elevated temperature sensors and one elevated wind monitor were in full service. Data recovery from these fixed sites were excellent. Also, a number of tethersounde launches were made to measure upper level temperatures on days of expected high ozone concentrations. Concurrently, VOC and carbonyl samples were collected at five surface sites and one elevated site.

In 1993, the data collected will be used in the urban airshed modeling of the Phoenix non-attainment area. The Maricopa Association of Governments has contracted with SAI to perform this modeling. ADEQ staff is concurrently working with the data and the urban airshed model as a means of providing meaningful comment on the SIP. In addition, ADEQ is developing expertise with a sophisticated air quality model.

F. SOUTHWESTERN FUEL CONSUMPTION AND EMISSION RESEARCH PROJECT

The Office of Air Quality is participating in research for the development of emission factors specific to Southwestern forest fuels beginning in the Fall of 1992. The field research will be conducted by the Pacific Northwest, Intermountain, and Pacific Southwest Forest and Range Experiment Stations of the US Forest Service in accordance with their Southwestern Fuel Consumption and Emissions Research proposal. The stations are responsible for locating the research burn sites, developing emission factor algorithms for southwestern fuel types, and incorporating the findings into periodic progress reports and existing smoke management and fuel consumption models.

ADEQ's objective in providing funding for this research is to support the research and investigation of emissions generated from prescribed burning activities in the Southwest. This research will be used to assist us in evaluating the impact of natural and prescribed forest burns in Arizona. The final report, anticipated to be released in 1995, will include an evaluation of the Black Hill's photo series, recommendations regarding litter and duff measurement, recommendations regarding pile measurement protocols and pile wood-to-air ratios, a user's manual for estimating pile loading, an evaluation of available fuel consumption models for use in ponderosa pine fuel types, summary of the preliminary development of the fuel consumption models for Arizona based on Southwest burns, and measurements of the preburn, piled fuel loading taken for the emission characterization study.

G. PAVED ROAD EMISSIONS STUDY

In the fall of 1993, ADEQ will be sponsoring a paved road emissions research study to determine vehicular particulate emissions (exhaust, brake, and tire wear) and re-entrainment of vehicular particulate emissions in the Phoenix Metropolitan area. The findings will be compared and contrasted with the Environmental Protection Agency (EPA) AP-42 Emission Factors and with the EPA MOBILE emission modeling formulas for particulate matter with an aerodynamic diameter of ten microns or less (PM_{10}). The goal of this research is to determine Phoenix based PM_{10} emission factors for paved roads for use in the Phoenix PM_{10} non-attainment area state implementation plan.

H. BORDER ENVIRONMENTAL STUDIES

A workplan to study hazardous air pollutants (HAPs) and PM_{10} in Mexico/US border communities was developed in cooperation with EPA, SEDSOL (the Mexican environmental agency), and Santa Cruz County. The field work will commence in Nogales in 1993 involving development of an emission inventory, air quality and meteorological monitoring, and modeling. Future work is scheduled for Douglas/Agua Prieta.

I. PAYSON PM_{10} SIP TECHNICAL PROTOCOL

In early 1993 a PM_{10} SIP protocol was developed for the Payson area summarizing the air quality monitoring and meteorological data collected in that area to date. This protocol also outlines a method for producing a comprehensive technical analysis of PM_{10} sources to be used in the development of a PM_{10} State Implementation Plan for the Payson area.

The major objectives of this protocol are to determine the methods for: 1) identifying the sources, point and area, that contribute to the high PM_{10} levels in Payson, b) determining the percentage of PM_{10} emissions due to contributing source categories through use of a receptor model, c) modeling the dispersion of PM_{10} emissions in the Payson area, d) reconciling the differences between the results of the receptor model and the dispersion model and e) projecting future PM_{10} concentrations that take into account local growth and potential PM_{10} control measures.

J. BULLHEAD CITY PM_{10} SIP MONITORING PLAN

EPA has proposed that the Bullhead City area be classified as a PM_{10} nonattainment area due to violations of the health standard for PM_{10} that occurred in 1989. ADEQ will prepare a PM_{10} SIP for the Bullhead City area to address these violations of the PM_{10} standard.

The first step in formulating the PM_{10} SIP will be to collect PM_{10} data in order to assess the temporal and spatial variations in PM_{10} emissions and to determine the significant sources that contribute to PM_{10} levels in the Bullhead City area. PM_{10} data in the Bullhead City area will be collected from April through August of 1993 at the following three locations: downtown Bullhead City, Holiday Shores, and Cottonwood Cove. ADEQ will also be locating a time-lapse camera on DRI mountain.

The PM_{10} data collected in this monitoring study will be used to: a) identify the sources, point and area, that contribute to the high PM_{10} emissions due to contributing source categories, b) assist in the development of a receptor model which will determine the percentage of PM_{10} emissions due to contributing source categories and c) develop the dispersion modeling scheme for modeling of PM_{10} emissions in the Bullhead City area. Any differences between the results of the receptor model and the dispersion model will be reconciled. It is hoped that through the use of these two models, ADEQ will be able to project future PM_{10} concentrations in the Bullhead City area and will be able to recommend potential PM_{10} control measures.

III. AIR QUALITY MONITORING PLANS FOR 1993

A. AMBIENT MONITORING/QUALITY ASSURANCE

Collocated high volume PM_{10} samplers will be installed at Safford (Andersen Model 1200) and Show Low (Wedding standard model) for the purpose of determining the precision of PM_{10} data obtained using these types of samplers. In addition, a dichotomous PM_{10} sampler (Andersen Model SA241MX) is to be installed at Nogales, the third collocated site for dichots (Paul Spur and Yuma are operational).

The ADEQ statewide meteorological network will be upgraded by the installation of an automated data acquisition system. Thus, retrieval of data and programming of the data loggers at the monitoring sites can be accomplished by telephone calls from the office.

O_3 precursors will be monitored in 1993 in the Phoenix metropolitan area as a follow-up to the 1992 O_3 study. The spatial range of precursor measurements will be expanded in 1993 to the perimeter areas of the Phoenix airshed as well as a small number of above ground samples collected using a tethered balloon system. This additional data will enable ADEQ to model O_3 more effectively using the Urban Airshed Model in connection with SIP development for the Phoenix nonattainment area.

A CO monitoring study will be conducted during the fall/winter of 1993/1994 to evaluate the results of modeling performed by EPA and to determine optimum locations for permanent monitoring stations. EPA's modeling identified two hotspot areas for CO, one in west central Phoenix and one in Tempe. Bag sampling equipment will be used to collect samples at a number of sites in each area.

B. MARICOPA COUNTY AMBIENT MONITORING NETWORK

A Maricopa County Ambient Air Monitoring Network Review Committee will be formed to administer a contract with AeroVironment, Inc. (A/V) of Monrovia, CA. This committee, composed of representatives of Maricopa County Division of Air Pollution Control, Maricopa Association of Governments, Intel Corporation, Salt River Project, EPA and ADEQ, will guide A/V in preparing a two-phase report. Phase I will address existing county air monitoring network deficiencies as they have been documented by EPA and ADEQ in reports of the past several years; the changes and improvements recommended in Phase I are planned for implementation in late 1993. Phase II will describe a future network for air monitoring in the county, based on 1990 Clean Air Act requirements, among others. This project will be funded by the Intermodal Surface Transportation Act funds, designed to assist in the solving air quality problems found in metropolitan areas with unhealthy levels of air pollution.

In conjunction with the Committee's review and recommendations, ADEQ will provide assistance and support by making instruments, towers, and trailers available for Maricopa County. Also, ADEQ will conduct performance audits of Maricopa County's monitoring sites on a routine basis.

C. NOGALES BORDER STUDY

For the purpose of assessing the extent of air quality problems in the Nogales, Arizona\Nogales, Sonora urban area, an ambient monitoring and source evaluation study is planned for the fall/winter of 1993/94. This investigation will focus on PM_{10} and hazardous air pollutants, including volatile and semi-volatile organic compounds, carbonyls, and metals. In addition to these pollutants, wind speed and wind direction will be monitored at a number of sites in the international Nogales urban area. Together with ambient monitoring, an emissions inventory for PM_{10} and other pollutants will be developed to evaluate air pollution control strategies. Funding for this study will be provided by EPA with assistance in field monitoring and source evaluation provided by staff of the Santa Cruz County Health Department and SEDESOL, the environmental control agency for the State of Sonora, Mexico.

D. BULLHEAD CITY PM_{10} STUDY

During the spring and summer of 1993 intensive monitoring for PM_{10} will be performed in the Bullhead City airshed. The objective of this project will be to determine an appropriate design value for PM_{10} modeling and SIP development for the Bullhead City area. PM_{10} modeling may be required if EPA designates Bullhead City a nonattainment area for PM_{10}. Exceedances of the 24-hour standard were monitored in 1989 and 1991 by Desert Research Institute which operates a monitoring network for Southern California Edison Company. In cooperation with Southern California Edison, ADEQ's study will utilize their sites for PM_{10} sampling and time-lapse photography.

E. PAVED ROAD EMISSIONS STUDY

In order to develop area-specific PM_{10} emission factors for motor vehicle traffic on paved highways and streets, a monitoring study will be conducted during the fall of 1993 in the Phoenix urban area. This research is necessary because the use of emission factors from EPA's AP-42 document have resulted in emission inventories substantially inconsistent with the results of urban haze and PM_{10} monitoring studies conducted in the Phoenix metropolitan area. This is not surprising since EPA's AP-42 factors for paved road PM_{10} emissions were derived from studies performed in other regions.

F. EMERGENCY RESPONSE MONITORING

For the purpose of responding to emergency incidents involving major releases of contaminants into the atmosphere, an emergency response program will be developed. This program will be developed in stages as follows:

- Personnel health and safety training
- Procurement of personal protective gear and equipment
- Medical monitoring of personnel
- Procurement of monitoring instruments and auxiliary equipment
- Equipping van for mobile monitoring

It is anticipated that resources available for this program will allow the purchase of the following instruments:

Gas chromatograph
Continuous PM_{10} monitor
SO_2 analyzer
CO analyzer
Meteorological sensors
Data logger

As more resources become available, instruments for monitoring various inorganic gases will be purchased.

G. PM_{10} SATURATION SAMPLING OF INDUSTRIAL FACILITIES

Intensive monitoring of PM_{10} emissions from specific industrial facilities will be performed to assess their impacts on ambient air quality. This information is required in connection with the review of operating permits issued by ADEQ. Facilities to be selected for saturation sampling include rock crushers, asphalt plants, concrete batch plants, and cotton gins because modeling is not a reliable method for determining their contributions to ambient PM_{10} concentrations. Compact, light weight, battery-powered samplers (Mini Vol Portable Sampler from Airmetrics, Springfield, Ore.) will be required to monitor at a number of remote sites around each source.

H. PHOENIX AND TUCSON LONG-TERM URBAN MONITORING NETWORKS

The technicians at PCDEQ and ADEQ will receive further training and continue the installation and operation of the aerosol and optical components comprising the two networks. Specific training in laboratory procedures prior to beginning the labor-intensive process of particulate filter data collection is planned, to ensure that standard EPA practices are being followed. Particulate filter sampling in the Tucson area will begin in mid-1993, with Phoenix-area sampling to begin later. Data from the first complete year of optical and aerosol sampling will be complied and reported.

I. HAZARDOUS AIR POLLUTANTS PROGRAM

A National Hazardous Air Pollutants (HAPs) program was established by Title III of the Clean Air Act Amendments of 1990. Subsequently, an Arizona HAPs program was authorized and defined by Senate Bill 1430. The Arizona HAPs program includes the federal requirements with some additions. In cooperation with the Department of Health Services, the United States Environmental Protection Agency and the National Academy of Sciences, the Department of Environmental Quality has undertaken a comprehensive research program to evaluate the existing risk to public health related to hazardous air pollution and to provide options and recommendations for programs to control the release of hazardous substances into the ambient air. In developing a HAPs program for Arizona, the Department of Environmental Quality will conduct research to investigate a broader range of HAPs pollutants, HAPs sources, and risk assessment methods to establish a HAPs inventory. The preliminary planning and implementation of a HAPs program has commenced.

IV. AIR QUALITY TRENDS

A. CARBON MONOXIDE

Over the past ten years the second highest 8-hour concentrations have declined in Phoenix and Tucson as shown by the graph in Figure 4. However, very little reduction in carbon Monoxide concentrations occurred in 1990 through 1992. To represent long-term trends in the Phoenix metropolitan area the neighborhood scale site at 1845 East Roosevelt Street, and the microscale site, 3315 West Indian School Road were chosen. For the Tucson urban area the microscale monitor located at 22nd and Alvernon Way was selected.

This decreasing trend in carbon monoxide levels in Phoenix is exaggerated by the plots of exceedances of the air quality exceedances of the air quality standard (see Figure 5). Thus, from a statistical perspective the trends in the second highest 8-hour concentrations are more meaningful. Nevertheless, the exceedance trend data are important for compliance and planning purposes.

B. LEAD

Since 1989 lead levels in Phoenix and Tucson have remained fairly constant at 0.05 to 0.10 $\mu g/m^3$, (see Figure 6). This is well below the air quality standard, $1.5\mu g/m^3$ for the maximum quarterly average. Prior to 1989 lead concentrations had declined each year as a result of reduced lead emissions from motor vehicles.

C. NITROGEN DIOXIDE

Long-term trend data for nitrogen dioxide in Phoenix are not available due to problems with equipment operation and quality assurance. Nevertheless, the meager quantity of data collected in recent years suggests that the annual average has varied from 25 to 50 $\mu g/m^3$. Thus, compliance with the annual standard of 100 $\mu g/m^3$ is indicated. In Tucson annual averages monitored at 22nd and Craycroft have been in the range of 30 to 38 $\mu g/m^3$ since 1984.

D. OZONE

In the Phoenix urban area the second highest 1-hour concentrations tended to decrease from 1983 through 1987 (see Figure 7). Then, no significant changes occurred in 1988 through 1991 followed by an increase in 1992. It should be noted that this long-term pattern is slightly different from trends reported in previous years because the network was expanded in 1990 when ADEQ installed O_3 monitors at Papago Park (2035 N. 52nd St.) and the ADEQ Vehicle Emissions Lab (600 N. 40th St.). Subsequently, higher concentrations of O_3 have been monitored at these two sites.

The exceedance data plotted in Figure 8 for the Phoenix metropolitan area do not follow the 1-hour trends except for 1992. In that year the exceedance data exaggerates the increasing trend observed in the concentration data.

In the Tucson metropolitan area the second highest 1-hour averages decreased from 1982 through 1986 followed by no appreciable changes through 1992. During the 1982 through 1992 period only one exceedance of the 1-hour standard of 0.12ppm was detected (in 1982). Therefore,

Tucson exceedance data were not included in Figure 8. In Yuma the second highest 1-hour average has not changed appreciably since 1986, remaining in the 0.09-0.10ppm range. Hence, compliance with the ozone standard was maintained throughout this monitoring period.

E. PM_{10}

In the Phoenix urban area PM_{10} concentrations tended to decrease from 1987 through 1990, and then stabilized in 1991 and 1992 (see Figure 9). As a result of this trend, annual averages declined below the level of the standard, 50$\mu g/m^3$, in 1990 at all three sites. From 1990 to 1992 they remained in the 40 to 48$\mu g/m^3$ range.

In Tucson a decreasing pattern is also evident, but unlike Phoenix, it persisted through 1992 (see Figure 10) and the reductions were much greater. Thus, the annual average dropped from 52$\mu g/m^3$ to 28$\mu g/m^3$ at the Prince Road site. A similar reduction is indicated for the Orange Grove Road site.

For other cities in Arizona, PM_{10} annual average concentrations for 1987 through 1992 are listed in Table 10. It can be seen that concentrations tended to decline in Clarkdale, Douglas, Flagstaff, Hayden, Nogales, Rillito and Safford through 1991. This trend appears to reflect actual changes in PM_{10} concentrations for various possible reasons, that is, reduced emissions, more favorable meteorology, etc. In 1991 and especially in 1992, however, a false decreasing trend appears in some of the data due to the replacement of Sierra Andersen high volume samplers with dichotomous samplers which measure lower PM_{10} concentrations. These replacements were made through 1991, thus, the full effect was not indicated until 1992 annual averages were determined. The greatest changes are seen in the data for Ajo, Miami, Organ Pipe, Paul Spur, Payson and Yuma. For no apparent reason, however, concentrations at Douglas, Hayden and Nogales did not change significantly with the use of dichot samplers in 1991 and 1992. It should be noted that dichot samplers were put into use in order to determine particle size fractions and chemical components of PM_{10} samples.

F. SULFUR DIOXIDE

1992 was the third consecutive year in which no exceedances of the 3-hour standard were monitored in the three smelter towns in Arizona (See Figure 11.) Miami had the best record over the past five years with no exceedances.

V. AIR QUALITY MONITORING NETWORKS

A. MONITORING NETWORKS

In Arizona, ambient air monitoring is conducted by a number of governmental agencies and regulated industries. A list of these monitoring network operators and the areas monitored is given below.

Agency or Industry	Area Monitored
Arizona Portland Cement Co.	Rillito
Arizona Public Service Co.	Joseph City
ASARCO, Inc.	Hayden
Century Power Corp.	Springerville
Cyprus Miami Mining Corp.	Miami
Magma Copper Co.	San Manuel
Maricopa County Environmental Quality and Public Health Service	Phoenix Metropolitan Area
National Park Service	National Monuments and Parks
Pima County Dept. of Environmental Quality	Tucson Metropolitan Area
Pinal County Air Quality Control District	Pinal County
Salt River Project	Page and St. Johns
Southern California Edison Co.	Bullhead City, AZ and Laughlin, NV
Tucson Electric Power Co.	Tucson and Springerville
Praxair, Inc.	Kingman

Maps indicating the locations of the Phoenix, Tucson and statewide monitoring stations are provided in Figures 1, 2, and 3. The Maricopa and Pima County networks are operated primarily to monitor urban-related air pollution. In contrast, the industrial networks are operated to monitor emissions from certain industrial facilities. State monitors are employed for a variety of purposes, including urban, industrial, rural and background surveillance. Finally, the National Park Service sites in Arizona have the unique objective of monitoring visibility in pristine areas in accordance with federal regulations for visibility protection. Included in this activity are measurements of various optical parameters as well as pollutant concentrations.

B. DATA REPORTING/QUALITY ASSURANCE

Ambient air quality data collected in 1992 by the various networks above are summarized in Section V. of this report. In addition, Maricopa and Pima Counties and some of the companies publish annual reports which include summaries of their data.

Raw data files are maintained by each of the network operators and are available upon request to them. In addition, the U.S. Environmental Protection Agency (EPA) stores raw data submitted quarterly by Maricopa and Pima Counties and the State. EPA analyzes these data for the purposes of evaluating progress in attaining and maintaining the NAAQS and reporting trends in air quality to the President and Congress.

Maricopa and Pima Counties report pollutant concentrations in the Phoenix and Tucson urban areas each day to the public via television, radio, newspapers and telephone. The data are reported in pollutant standard index (PSI) units, that is, units of concentrations relative to the standards. These reports include the descriptor words "good", "moderate", "unhealthy", "very unhealthy", or "hazardous", depending on pollutant levels.

The industrial operators submit either monthly or quarterly data reports to the state, depending on the type of facility. In addition, they are required to report any exceedance of an air quality standard by the next working day. The report includes an explanation of the causes of the exceedance and corrective actions to be taken, if possible, to prevent future occurrences.

To ensure that valid data are obtained, each network operator conducts a quality assurance program in accordance with state and federal requirements.

VI. AIR QUALITY DATA FOR 1992

Table 2 lists the counties and towns monitored in the state and the pollutants for which data are listed.

1992 data summaries, which are tabulated in Tables 3 through 9, consist of the following:

- Mean concentrations for the calendar year;
- Highest concentrations for shorter time intervals;
- Number of exceedances of air quality standards; and
- Number of samples collected or hours monitored.

In the data summaries, the following abbreviations and footnotes were used:

General

NA . . . . . Not Applicable
NR . . . . . Not Reported

Operators

APC . . . . . Arizona Portland Cement Company
APS . . . . . Arizona Public Service Company
ASARCO . . . . . ASARCO
CM . . . . . Cyprus Miami Mining Corporation
Magma . . . . . Magma Copper Company
Maricopa . . . . . Maricopa County Environmental Quality and Public Health Services
NPS . . . . . National Park Service
Pima . . . . . Pima County Department of Environmental Quality
Pinal . . . . . Pinal County Air Quality Control District
SRP . . . . . Salt River Project
SCE . . . . . Southern California Edison Company
State . . . . . Arizona Department of Environmental Quality
TEP . . . . . Tucson Electric Power Company
PRAX . . . . . Praxair, Inc.

Equipment

Carbon Monoxide

GFC	Gas filter correlation

Nitrogen Dioxide

Chem	Chemiluminescent

Ozone

UV	Ultraviolet absorption

PM_{10}

SA321B	Sierra Andersen 321B hi-vol
SA1200	Sierra Andersen 1200 hi-vol
Wed	Wedding hi-vol
Dichot	Dichotomous
Imp.	Improve

Sulfur Dioxide

Coul	Coulometric
Fluor	Fluorescent

Footnotes:

a. New site
b. Site terminated
c. Mean value based on a limited number of samples. State and Federal rules require 75% data recovery.
d. Site operated on a seasonal schedule
e. Site operated on an event basis
f. Units for Pb are ng/m^3
g. Data for Pb and SO_4 are for particles smaller than 2.5 um

Table 1

Summary of Ambient Air Quality Standards
State and Federal Standards [a]
In $\mu g/m^3$ (and ppm)

Pollutant	Averaging Time	Primary	Secondary
Carbon Monoxide[b]	1-hr. 8-hr.	40 (35) 10 (9)	40 (35) 10 (9)
Nitrogen Dioxide	Annual	100 (.05)	100 (0.5)
Ozone	1-hr.	235 (.12)	235 (.12)
PM_{10}	24-hr./Annual	150/50	150/50
Sulfur Dioxide	3-hr. 24-hr. Annual	— 365 (.14) 80 (0.3)	1300 (.5) — —
Lead	Calendar Qtr.	1.5	1.5

Summary of Emergency Episode Levels
State and Federal
In $\mu g/m^3$ (and ppm)

Pollutant	Averaging Time	Alert	Warning	Emergency	Significant Harm
Carbon Monoxide	1-hr. 4-hr. 8-hr.	— — (15)	— — (30)	— — (40)	(125) (75) (50)
Nitrogen Dioxide	1-hr. 24-hr.	1130 (.6) 282 (.15)	2260 (1.2) 565 (.3)	3000 (1.6) 750 (.4)	3750 (2.0) 938 (.5)
Ozone	1-hr.	400 (.2)	800 (.4)	1000 (.5)	1200 (.6)
PM_{10}	24-hr.	350 (-)	420 (-)	500 (-)	600 (-)
Sulfur Dioxide	24-hr.	800 (.3)	1600 (.6)	2100 (.8)	2620 (1.0)

[a] Standards are not to be exceeded more than once per year with two exceptions. In the case of ozone and PM_{10}, compliance is determined by the number of days on which the O_3 or PM_{10} standard is exceeded. The number of exceedance days per year, based on a 3-year running average, is not to exceed 1.0.

[b] In mg/m^3 (and ppm)

Table 2
1992 Counties and Towns Monitored

County and Town	Carbon Monoxide	Lead	Nitrogen Dioxide	Ozone	PM_{10}	Sulfur Dioxide	Sulfate
APACHE:							
Petrified Forest		X	X	X	X	X	X
St. Johns			X	X	X	X	
Springerville			X		X	X	
COCHISE:							
Bisbee Junction					X		
Chiricahua		X	X		X	X	X
Douglas					X		
Naco					X		
Paul Spur					X		
COCONINO:							
Flagstaff					X		
Grand Canyon		X	X	X	X	X	X
Page			X	X		X	
Sedona					X		
GILA:							
Hayden					X	X	X
Miami					X	X	X
Payson					X		
Pinto Valley					X		
San Carlos Indian Reservation					X		

Table 2 (Cont'd)
1992 Counties and Towns Monitored

County and Town	Carbon Monoxide	Lead	Nitrogen Dioxide	Ozone	PM_{10}	Sulfur Dioxide	Sulfate
GILA (Contd.)							
Tonto (NM)		X			X		X
Winkelman						X	
GRAHAM:							
Safford					X		
MARICOPA:							
Chandler					X		
Glendale	X			X	X		X
Mesa	X			X	X		
Phoenix	X	X		X	X	X	X
Scottsdale	X			X	X		X
MOHAVE:							
Bullhead City			X		X	X	
Holiday Shores			X	X	X	X	
Kingman					X		
McConnico					X		
Riviera					X	X	
NAVAJO:							
Joseph City					X		
Show Low					X		
White River					X		

Table 2 (Cont'd)
1992 Counties and Towns Monitored

County and Town	Carbon Monoxide	Lead	Nitrogen Dioxide	Ozone	PM_{10}	Sulfur Dioxide	Sulfate
PIMA							
Ajo					X		
Green Valley					X		
Organ Pipe (NM)					X		X
Rillito					X		
Saguaro		X	X	X	X	X	X
Tucson	X	X	X	X	X	X	X
PINAL:							
Apache Junction	X			X	X		
Casa Grande				X	X		
Coolidge					X		
Marana					X		
Oracle						X	
San Manuel						X	
Stanfield					X		
SANTA CRUZ:							
Nogales					X		X
YAVAPAI:							
Clarkdale					X		
Montezuma Castle (NM)					X		
Nelson					X		
Prescott					X		

Table 2 (Cont'd)
1992 Counties and Towns Monitored

County and Town	Carbon Monoxide	Lead	Nitrogen Dioxide	Ozone	PM_{10}	Sulfur Dioxide	Sulfate
YUMA:							
Somerton					X		
Yuma				X	X		

Table 3
1992 Carbon Monoxide Data (in ppm)

County and City	Site Location	Operator	Method	1-HR AVERAGE Max	1-HR AVERAGE 2ndHi	8-HR AVERAGE Max	8-HR AVERAGE 2ndHi	NUMBER OF EXCEEDENCES Day	NUMBER OF EXCEEDENCES Times	Number of Samples
MARICOPA:										
Glendale	6000 W. Olive	Maricopa	GFC	8.6	8.0	4.2	4.0	0	0	7754
Mesa	Broadway & Brooks	Maricopa	GFC	8.6	8.5	6.5	5.4	0	0	8469
Phoenix	4732 S. Central	Maricopa	GFC	9.9	8.4	5.2	4.9	0	0	8616
Phoenix	1845 E. Roosevelt	Maricopa	GFC	11.5	10.3	8.7	8.2	0	0	8551
Phoenix	601 E. Butler Dr.	Maricopa	GFC	9.6	9.5	5.3	5.0	0	0	8739
Phoenix	3315 W. Indian School Rd.	Maricopa	GFC	13.5	12.5	10.1	9.3	1	1	8402
Phoenix	3847 W. Earll	Maricopa	GFC	13.7	12.1	9.3	9.2	0	0	8668
Phoenix	4530 N. 17th Ave.	State	GFC	11.0	10.8	9.1	7.6	0	0	4368
Phoenix	27th Ave./Grand/Thomas	State	GFC	14.9	14.9	9.7	9.6	3	3	3462
Phoenix[a]	3905 N. 7th Ave.	State	GFC	12.0	10.6	9.6	9.0	1	1	1442
Phoenix[a]	South 32nd St.	State	GFC	8.6	7.0	6.3	5.4	0	0	1450
Scottsdale	2857 N. Miller Rd.	Maricopa	GFC	9.5	8.7	6.1	6.1	0	0	8647
Scottsdale	13665 N. Scottsdale Rd.	Maricopa	GFC	6.6	5.5	2.8	2.7	0	0	8660
PIMA:										
Tucson	190 W. Pennington	Pima	GFC	8.7	8.1	5.0	4.8	0	0	8110
Tucson	22nd & Craycroft	Pima	GFC	7.5	7.2	3.5	3.3	0	0	7508
Tucson	22nd & Alvernon	Pima	GFC	12.5	11.2	6.1	5.8	0	0	8599
Tucson	346 N. Cloverland	Pima	GFC	7.4	6.0	4.1	3.9	0	0	4227
Tucson	2745 N. Cherry	Pima	GFC	8.6	7.6	5.7	5.0	0	0	4623
Tucson	Broadway & Craycroft	Pima	GFC	8.5	7.6	5.4	5.3	0	0	4494

Table 3 (Cont'd)
1992 Carbon Monoxide Data (in ppm)

County and City	Site Location	Operator	Method	1-HR AVERAGE Max	1-HR AVERAGE 2ndHi	8-HR AVERAGE Max	8-HR AVERAGE 2ndHi	NUMBER OF EXCEEDENCES Day	NUMBER OF EXCEEDENCES Times	Number of Samples
PIMA (Cont'd):										
Tucson	4829 N. Sabino Canyon Rd.	Pima	GFC	5.2	4.1	2.2	1.8	0	0	7776
Tucson	12101 N. Camino de Oeste	Pima	GFC	2.2	1.8	1.3	1.2	0	0	8239
Tucson	4591 N. Pomona	Pima	GFC	8.2	8.0	5.0	4.8	0	0	7427
PINAL:										
Apache Junction	County Courthouse	Pinal	GFC	6.5	6.4	1.7	1.6	0	0	5257

STATE AND FEDERAL STANDARD (ppm): 1-Hour Average 35 8-Hour Average 9

Table 4
1992 Lead Data (in $\mu g/m^3$)
In TSP or PM_{10}

County and City	Site Location	Operator	IN	QUARTERLY AVERAGE 1	2	3	4	NUMBER OF SAMPLES 1	2	3	4
APACHE:											
Petrified Frst.	1 mi. N. of Park Headquarters	NPS	PM_{10}	1.6[fg]	1.3	1.07	.69	16	26	11	22
COCHISE:											
Douglas	City Park	STATE	PM_{10}	.08	.03	.03	.01	16	14	15	11
Chiricahua NM	Faraway Ranch	NPS	PM_{10}	2.6[fg]	1.7	1.4	2.1	24	21	25	25
COCONINO:											
Grand Canyon NP	Hopi Point	NPS	PM_{10}	.88[fg]	1.02	.64	.45	13	16	11	25
Grand Canyon NP	Indian Gardens	NPS	PM_{10}								
GILA:											
Hayden	Old Town Jail	State	PM_{10}	.09	.09	.07	.08	15	12	12	13
Miami South	Nolan Ranch	State	PM_{10}	.04	.04	.04	0	13	14	10	1
Tonto	Maintenance Station	NPS	PM_{10}	2.9[fg]	2.6	1.3	3.1	16	26	7	21
MARICOPA:											
Phoenix	1845 E. Roosevelt	Maricopa	TSP	.04	.02	.02	.06	15	15	7	15
Phoenix	1826 W. McDowell	Maricopa	TSP	.04	.03	.02	.05	15	14	3	10
PIMA:											
Organ Pipe	Visitor's Center	State	PM_{10}	0	0	0	0	14	14	10	15
Saguaro NM	Rincon Mountain Unit	NPS	PM_{10}	5.5[fg]	3.1	1.9	1.8	25	22	26	22
Tucson	1016 W. Prince Rd.	Pima	TSP	.05	.02	.04	.06	16	14	14	14
Tucson	22nd & Craycroft	Pima	TSP	.01	.01	.01	.01	6	15	15	14

Table 4 (Cont'd)
1992 Lead Data (in $\mu g/m^3$)
In TSP or PM_{10}

County and City	Site Location	Operator	IN	QUARTERLY AVERAGE 1	2	3	4	NUMBER OF SAMPLES 1	2	3	4
SANTA CRUZ:											
Nogales	U.S. Post Office	State	PM_{10}	.10	.05	.04	.05	14	14	10	14
YAVAPAI:											
Clarkdale	SE Cement Plant	PC	PM_{10}	.0028	.0051	.0033	.0052	3	3	3	3
Montezuma Castle	Maintenance Building	State	PM_{10}	.01	0	.01	0	16	14	15	15

STATE AND FEDERAL STANDARD ($\mu g/m^3$): Calendar Quarter Average
(Primary and Secondary) 1.5

Table 5
1992 Nitrogen Dioxide Data (in $\mu g/m^3$)

County and City	Site Location	Operator	Method	Annual Average	Maximum 1-HR	Maximum 24-HR	No. of 1-HR Samples
APACHE:							
St. Johns	Mesa Parada	SRP	Chem	5	48	22	7950
Springerville	Airport	TEP	Chem	6	38	13	7350
Springerville	4 mi. NE of town	TEP	Chem	4	68	53	7594
Springerville	1 mi. NNE of unit 1 stack	TEP	Chem	4	68	17	7617
Springerville	1 mi. ESE of unit 1 stack	TEP	Chem	4	49	15	7415
Springerville	1 mi. SSE of unit 1 stack	TEP	Chem	4	64	15	7570
Springerville	12.2 mi. SE of unit 1 stack	TEP	Chem	2	75	13	7345
COCONINO:							
Page	Glen Canyon Dam	SRP	Chem	3	55	18	8188
MOHAVE:							
Bullhead City	224 N. Main	SCE	Chem	26	102	60	8510
Holiday Shores	1436 Tonto Dr.	SCE	Chem	24	111	58	8232
PIMA:							
Tucson	22nd & Craycroft	Pima	Chem	31	128	71	8613
Tucson	190 W. Pennington	Pima	Chem	46	173	81	8553
Tucson	4591 N. Pomona Avenue	Pima	Chem	43	173	102	7955

STATE AND FEDERAL STANDARD ($\mu g/m^3$): Annual Average
(Primary and Secondary) 100

Table 6
1992 Ozone Data (in ppm)

County and City	Site Location	Operator	Method	1-HR MAX Day	2nd HI Day	Number of Exceedances	Number of Samples
APACHE:							
Petrified Forest[b]	1 mi. from Visitor Ctr.	NPS	UV	.07	.06	0	2334
St. Johns	Mesa Parada	SRP	UV	.08	.08	0	8376
COCHISE:							
Chiricahua NM	Western entrance to NM	EPA	N/R	N/R	N/R	N/R	N/R
COCONINO:							
Grand Canyon	2 mi. W. of Hopi Point	NPS	UV	.08	.07	0	8301
Grand Canyon	2 mi. W. of Hopi Point	EPA	UV	N/R	N/R	N/R	N/R
Page	Glen Canyon Dam	SRP	UV	.08	.07	0	4947
MARICOPA:							
Glendale	6000 W. Olive	Maricopa	UV	.12	.12	0	8671
Mesa	Broadway & Brooks	Maricopa	UV	.13	.12	1	8628
Mesa	4530 E. McKellips Rd.	Maricopa	UV	.11	.11	0	7970
Peoria	8915 W. Union Hills	Maricopa	UV	.11	.11	0	N/R
Phoenix	2035 52nd St.	State	UV	.15	.14	3	3529
Phoenix	1845 E. Roosevelt	Maricopa	UV	.13	.12	1	8733
Phoenix	601 E. Butler	Maricopa	UV	.13	.11	1	8700
Phoenix	600 N. 40th St.	State	UV	.16	.15	4	3660
Phoenix	3847 W. Earll	Maricopa	UV	.11	.10	0	8384
Phoenix	4732 S. Central	Maricopa	UV	.10	.10	0	8547
Scottsdale	2857 N. Miller	Maricopa	UV	.12	.11	0	8615

Table 6 (Cont'd)
1992 Ozone Data (in ppm)

County and City	Site Location	Operator	Method	1-HR MAX Day	2nd HI Day	Number of Exceedances	Number of Samples
MARICOPA (Cont'd):							
Scottsdale	13665 N. Scottsdale Rd.	Maricopa	UV	.12	.11	0	8242
Scottsdale	24301 N. Alma School Rd.	Maricopa	UV	.12	.11	0	8274
Scottsdale	10005 E. Osborn	State	UV	.13	.12	1	2105
MOHAVE:							
Holiday Shores	1436 Tonto Drive	SCE	UV	.09	.09	0	8509
PIMA:							
Saguaro NM E	3905 S. Old Spanish Trail	NPS	UV	.10	.10	0	7746
Tucson	190 W. Pennington	Pima	UV	.08	.08	0	8620
Tucson	22nd & Craycroft	Pima	UV	.11	.09	0	8179
Tucson	4591 N. Pomona	Pima	UV	.09	.08	0	8220
Tucson	11330 S. Houghton	Pima	UV	.08	.08	0	8706
Tucson	12101 N. Camino de Oeste	Pima	UV	.09	.08	0	8651
Tucson	4829 W. Sabino Canyon Rd.	Pima	UV	.09	.08	0	8486
PINAL:							
Apache Junction	County Court House	Pinal	UV	.06	.05	0	744
Casa Grande	Airport - N. Pinal	Pinal	UV	.08	.06	0	5679
YUMA:							
Yuma	1485 Second Ave.	State	UV	.12	.10	0	2853

STATE AND FEDERAL STANDARD: The standard is .12ppm (235 $\mu g/m^3$) for the maximum daily 1-hour concentration, not to be exceeded (Primary and Secondary) more than three times in three years. No more than 1.0 exceedances per year over the last three years is permitted.

Table 7
1992 PM_{10} Data (in $\mu g/m^3$)

County and City	Site Location	Operator	Method	Annual Average	24-Hour Average MAX	24-Hour Average 2ndHi	Number of Exceedances 150 $\mu g/m^3$	Number of Samples
APACHE:								
Petrified Forest	1 mi. from Visitor Center	NPS	Improve	8	17	16	0	72
St. Johns	Mesa Parada	SRP	Dichot	8[c]	14	11	0	34
St. Johns	Patterson Wellfield	SRP	Dichot	9[c]	15	14	0	39
Springerville	Coyote Hills 105m SSW of stack	TEP	Dichot	32	162	132	1	300
Springerville	Plant 1 mi. NE of stack	TEP	Dichot	43	270	139	1	46
COCHISE:								
Bisbee Junction	Lindstrom Ranch	State	SA1200	22[c]	48	45	0	52
Chiricahua NM	Faraway Ranch	NPS	Improve	8	22	20	0	94
Douglas	City Park	State	Dichot	40	138	109	0	57
Naco[a]	Port of Entry	State	SA1200	64[c]	119	115	0	29
Paul Spur	Housing area	State	Dichot	62	139	132	0	51
COCONINO:								
Flagstaff	Cherry & Agassiz	State	Wedd'g	27[c]	82	69	0	16
Flagstaff	5701 E. Railroad Ave.	State	Wedd'g	28	106	80	0	44
Flagstaff[b]	519 W. Deanna Dr.	State	Dichot	35[c]	88	48	0	15
Flagstaff[a]	Thorpe Park	State	Dichot	23[c]	46	45	0	34
Grand Canyon	Hopi Point	NPS	Improve	8	17	16	0	61
Grand Canyon	Indian Gardens	NPS	Improve	N/R	N/R	N/R	N/R	N/R
Sedona	Post Office	State	SA322	15	27	26	0	53

Table 7 (Cont'd)
1992 PM_{10} Data (in $\mu g/m^3$)

County and City	Site Location	Operator	Method	Annual Average	24-Hr Average MAX	24-Hr Average 2ndHi	Number of Exceedances 150 $\mu g/m^3$	Number of Samples
GILA:								
Hayden	Old Town Jail	State	Dichot	35	85	83	0	53
Miami	Golf Course	CMMC	Dichot	24	59	50	0	90
Miami	Ridgeline	CMMC	Dichot	14	34	32	0	86
Miami South	Nolan Ranch	State	Dichot	14[e]	35	34	0	41
Payson	USWest Building	State	Dichot	40	130	108	0	56
Pinto Valley	Pinto Valley	CCC/AEC	Weddn'g	22	49	42	0	27
San Carlos Indian Reservation	San Carlos Industrial Park	SCAIT/AEC	SA321B	11	29	26	0	37
Tonto	Maintenance Station	NPS	Improve	12	31	26	0	48
GRAHAM:								
Safford	523 Tenth Ave.	State	SA1200	32	142	86	0	59
MARICOPA:								
Chandler	1475 E. Pecos Rd.	Maricopa	SA1200	56	156	126	1	49
Glendale	6000 W. Olive	Maricopa	SA321B	34	120	60	0	49
Mesa	Broadway & Brooks	Maricopa	SA1200	29	106	59	0	44
Phoenix	4732 S. Central	Maricopa	SA321B	48	171	158	2	55
Phoenix	3847 W. Earll	Maricopa	SA321B	47	147	102	0	52
Phoenix	1845 E. Roosevelt	Maricopa	SA321B	42	86	73	0	20
Phoenix	601 E. Butler	Maricopa	SA321B	35	88	66	0	51
Scottsdale	2857 N. Miller Rd.	Maricopa	SA321B	34	115	61	0	61

Table 7 (Cont'd)
1992 PM_{10} Data (in $\mu g/m^3$)

County and City	Site Location	Operator	Method	Annual Average	24-Hr Average MAX	24-Hr Average 2nd HI	Number of Exceedances 150 $\mu g/m^3$	Number of Samples
MARICOPA (Cont'd)								
Scottsdale	13665 N. Scottsdale Rd.	Maricopa	SA1200	30	60	60	0	58
MOHAVE:								
Bullhead City	224 N. Main	SCE	SA321B	30	96	70	0	61
Holiday Shores	1436 Tonto Dr.	SCE	SA321B	22	42	42	0	59
Kingman	I-40 and Griffith Rd.	PRAXAIR	SA1200	17	29	27	0	111
McConnico	I-40 access road	NSSC/AEC	Wedd'g	15	26	22	0	31
Riviera	Fort Mohave	SCE	SA321B	23	59	51	0	61
NAVAJO:								
Joseph City	Third & Tanner	APS	Wedd'g	17	36	29	0	61
Show Low	Deuce of Clubs Ave.	State	Wedd'g	21	100	74	0	50
White River	Sheriff's Office	State	Wedd'g	23	39	36	0	54
PIMA:								
Ajo	Well Road	State	Dichot	23	47	42	0	48
Corona de Tucson	22000 S. Houghton	Pima	SA1200	12	30	30	0	58
Green Valley	245 W. Esperanza	Pima	SA1200	15	26	25	0	59
Organ Pipe NM	Visitors Center	State	Dichot	11	30	24	0	53
Rillito	8820 W. Water	State	Dichot	33	96	95	0	56
Rillito	Gremler Residence	CAL-MAT	Wedd'g	28	82	78	0	200
Saguaro NM	Rincon Mountain Unit	NPS	Improve					
Tucson	Broadway & Swan	Pima	SA1200	26	73	56	0	61

Table 7 (Cont'd)
1992 PM_{10} Data (in $\mu g/m^3$)

County and City	Site Location	Operator	Method	Annual Average	24-Hr Average MAX	24-Hr Average 2ndHi	Number of Exceedances 150 $\mu g/m^3$	Number of Samples
PIMA (Cont'd) :								
Tucson	360 S. Church	Pima	SA1200	28	70	69	0	244
Tucson	Golf Link & Harrison	Pima	SA1200	20	58	42	0	61
Tucson	.5m E. Irvington & Alvernon	TEP	SA321B	23	62	60	0	60
Tucson	3401 W. Orange Grove	Pima	SA321B	30	102	79	0	178
Tucson	1016 W. Prince Rd.	Pima	SA1200	28	73	67	0	58
Tucson	1810 S. 6th Ave.	Pima	SA1200	31	81	60	0	60
Tucson	2nd St. & Palm Ave.	Pima	SA1200	29	114	69	0	59
Tucson	7290 W. Tanque Verde	Pima	SA1200	21	54	51	0	61
PINAL:								
Apache Junction	County Court	Pinal	Wedd'g	22	64	61	0	58
Casa Grande	401 Marshall Rd.	Pinal	Wedd'g	30	127	88	0	59
Coolidge[a]	County Highway Yard	Pinal	Wedd'g	35[e]	77	71	0	36
Marana[a]	Pinal Air Park	Pinal	SA1200	29[e]	82	41	0	8
Stanfield	County Courthouse	Pinal	Wedd'g	26[e]	137	118	0	38
SANTA CRUZ:								
Nogales	U.S. Post Office	State	Dichot	54	153	146	1	53
YAVAPAI:								
Clarkdale	SE of CTI Flyash Silos	PC	Dichot	24	67	48	0	58
Clarkdale	Clarkdale Fire Station	State	Wedd'g	16[e]	52	23	0	22

Table 7 (Cont'd)
1992 PM_{10} Data (in $\mu g/m^3$)

County and City	Site Location	Operator	Method	Annual Average	24-Hr Average MAX	2nd HI	Number of Exceedances 150 $\mu g/m^3$	Number of Samples
YAVAPAI (Cont'd):								
Clarkdale	Northwest of Cement Plant	PC	Dichot	22[e]	42	42	0	42
Montezuma Castle	Maintenance Building	State	Dichot	16	81	31	0	60
Nelson	Chemstar Lime Plant	State	Dichot	21[e]	71	62	0	45
Prescott	City Administration	State	Wedd'g	19	37	34	0	48
YUMA:								
Somerton[a]	Fire Station	State	Dichot	38[e]	91	75	0	39
Yuma	2795 Avenue B	State	Dichot	29	62	60	0	52

	Annual Arithmetic Mean	24-Hour Average
FEDERAL STANDARDS (ug/m^3): (Primary and Secondary)	50	150

Table 8
1992 Sulfur Dioxide Data (in $\mu g/m^3$)

County and City	Site Location	Operator	Method	Annual Average	MAX 3-Hr Hr	MAX 24-	NO. OF EXCEEDANCES 3-Hr Days	NO. OF EXCEEDANCES 24-Hr Times	1-Hr Samples
APACHE:									
St. Johns	Mesa Parada	SRP	Fluor	4	59	23	0	0	7999
Springerville	4 mi. NE of town	TEP	Fluor	3	37	11	0	0	7534
Springerville	Airport	TEP	Fluor	3	47	26	0	0	7621
Springerville	1 mi. NNE-unit 1 stack	TEP	Fluor	5	134	31	0	0	7709
Springerville	1 mi. ESE-unit 1 stack	TEP	Fluor	5	149	31	0	0	7534
Springerville	1 mi. SSE-unit 1 stack	TEP	Fluor	8	152	37	0	0	7534
Springerville	12.2 mi. SE-unit 1 stack	TEP	Fluor	5	58	21	0	0	7446
COCONINO:									
Page	Glen Canyon Dam	SRP	Fluor	5	107	47	0	0	8055
GILA:									
Hayden	Garfield Ave.	ASARCO	Fluor	28	866	344	0	0	8764
Hayden	Jail	ASARCO	Fluor	15	402	71	0	0	8716
Hayden	Hayden Junctions	ASARCO	Fluor	7	343	48	0	0	8746
Hayden	Montgomery Ranch	ASARCO	Fluor	41	626	193	0	0	8726
Hayden	Jail	State	Fluor	16	815	238	0	0	8384
Miami	Nolan Ranch	State	Fluor	8°	875	128	0	0	7303
Miami	Jones Ranch	CMMC	Fluor	6	537	95	0	0	8760
Miami	Whtfld./Burch Pump Station	CMMC	Fluor	0	23	8	0	0	8760
Miami	Town Site	CMMC	Fluor	4	383	52	0	0	8760
Winkelman	1 mile north Jct. 77 & 177	ASARCO	Fluor	28	672	205	0	0	8746

Table 8 (Cont'd)
1992 Sulfur Dioxide Data (in $\mu g/m^3$)

County and City	Site Location	Operator	Method	Annual Average	MAX 3-Hr	MAX 24-Hr	NO. OF EXCEEDANCES 3-Hr. Days	NO. OF EXCEEDANCES 24-Hr. Times	1-Hr Samples
MARICOPA:									
Phoenix	1845 E. Roosevelt	Maricopa	Fluor	11	53	27	0	0	7820
MOHAVE:									
Bullhead City	224 N. Main	SCE	Fluor	6	123	24	0	0	8529
Holiday Shores	1436 Tonto Dr.	SCE	Fluor	6	147	39	0	0	8486
Riviera	Fort Mohave	SCE	Fluor	4	160	34	0	0	8472
PIMA:									
Saguaro NM	3905 S. Old Spanish Trail	NPS	Coul	5	44	24	0	0	7747
Tucson	22nd & Craycroft	Pima	Fluor	5	80	19	0	0	5230
PINAL:									
Oracle	Courthouse	Magma	Fluor	5	463	75	0	0	8772
Oracle	3 C Ranch	Magma	Fluor	7	307	49	0	0	8774
San Manuel	Townsite	Magma	Fluor	26	923	197	0	0	8773
San Manuel	Golf Course	Magma	Fluor	14	508	163	0	0	8771
San Manuel	Dormsite	Magma	Fluor	32	783	189	0	0	8774
San Manuel	Minesite	Magma	Fluor	17	553	115	0	0	8774
San Manuel	LDS Church	State	Fluor	10[e]	519	121	0	0	7794
San Manuel	Elks	Magma	Fluor	42	1247	225	0	0	8774
San Manuel	Hospital	Magma	Fluor	38	1179	242	0	0	8768

STATE AND FEDERAL STANDARDS ($\mu g/m^3$):	Annual Average	24-Hour Average	3-Hour Average
Primary	80	365	—
Secondary			1300

Table 9
1992 Sulfates Data (in $\mu g/m^3$)

County and City	Site Location	Operation	IN	Annual Average	24-Hr AVERAGE Max	2ndHi	Number of Samples
APACHE:							
Petrified Forest	1 mi. N of Park Headquarters	NPS	PM_{10}	N/R	N/R	N/R	N/R
COCHISE:							
Chiricahua NM	Faraway Ranch	NPS	PM_{10}	N/R	N/R	N/R	N/R
Douglas	City Park	State	Dichot	.8	4.4	2.7	53
COCONINO:							
Grand Canyon	Hopi Point	NPS	PM_{10}	N/R	N/R	N/R	N/R
Grand Canyon	Indian Gardens	NPS	Improve	N/R	N/R	N/R	N/R
GILA:							
Hayden	Jail	State	Dichot	1.5	2.7	2.7	53
Miami South*	Nolan Ranch	State	Dichot	2.2	4.6	4.5	41
Tonto	Maintenance Station	NPS	PM_{10}	N/R	N/R		N/R
MARICOPA:							
Glendale	6000 W. Olive	Maricopa	PM_{10}	1.8	3.3	2.5	49
Phoenix	1845 E. Roosevelt	Maricopa	PM_{10}	2.1	3.9	3.6	20
Phoenix	4732 S. Central	Maricopa	PM_{10}	2.1	4.9	4.6	55
Phoenix	3847 W. Earll	Maricopa	PM_{10}	2.6	5.9	5.6	52
Scottsdale	2857 N. Miller Rd.	Maricopa	PM_{10}	1.9	5.2	4.9	61

Table 10
PM_{10} Concentrations in Various Cities
Annual Average ($\mu g/m^3$)

SITE	1987	1988	1989	1990	1991	1992
Ajo	39[a]	42[a]	41[a]	44[a]	31[ac]	23
Bullhead City	—	37	52	39	34	30
Apache Junction	22[a]	22	16[a]	23[a]	30	22
Casa Grande	36	44	43[a]	32	29[a]	30
Clarkdale	—	—	24[a]	28[a]	18	16[a]
Douglas	52	57	55[a]	38[a]	39[c]	40
Flagstaff	29[a]	21[a]	24[a]	29[a]	22	24[bc]
Hayden	56	52	46	35	36[c]	35
Joseph City	20	25	26	21	21	17
Miami South	21	24[a]	28	27[ab]	15[ac]	14[a]
Montezuma Castle	—	—	—	—	12[c]	16
Nogales	72	69	63	52	50[c]	54
Organ Pipe	17	16	19	23	11[c]	11
Paul Spur	56	79	122	79[a]	67[c]	62
Payson	40[a]	79[a]	79	67	48[ac]	40
Rillito	59	69	94	40	27[c]	33
Safford	32	42	44	28	24	32
Show Low	25[a]	23	23	22	18[a]	21
Yuma	—	—	52[a]	57	48[c]	29

[a] Mean value based on a limited number of samples.
[b] Site Relocated Mid Year
[c] Sample type changed
Annual standard - 50 $\mu g/m^3$

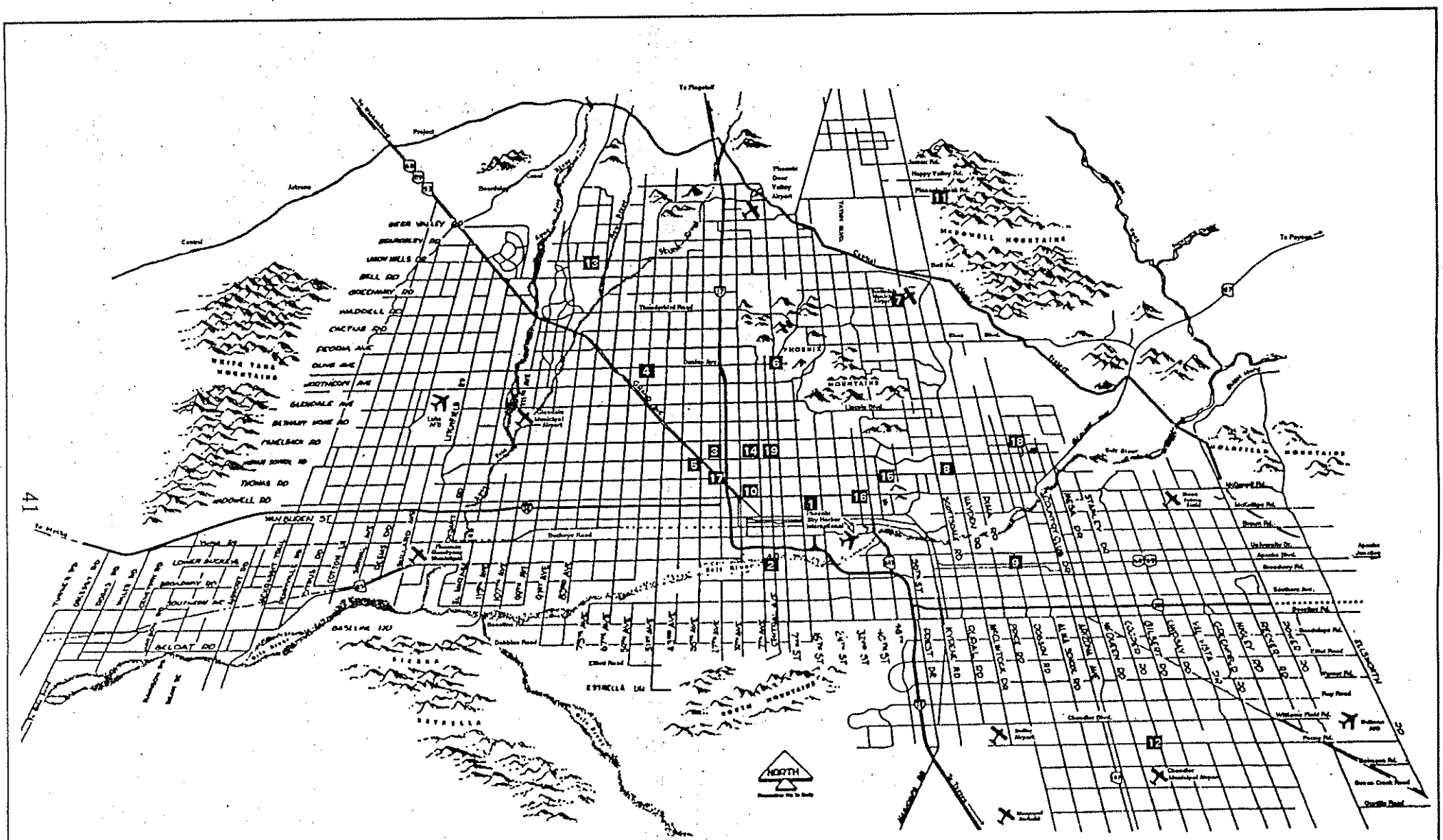


Figure 1
MARICOPA COUNTY MONITORING NETWORK

Map Key for Figure 1
Maricopa County Monitoring Network

Map Number	Site
1	1845 East Roosevelt - Phoenix
2	4732 South Central - Phoenix
3	3315 West Indian School - Phoenix
4	6000 West Olive - Glendale
5	3847 West Earll - Phoenix
6	601 East Butler - Phoenix
7	13665 North Scottsdale - Scottsdale
8	2857 North Miller - Scottsdale
9	Broadway & Brooks - Mesa
10	1826 West McDowell - Phoenix
11	24301 North Alma School - Scottsdale
12	1475 East Pecos - Chandler
13	8915 W. Union Hills - Peoria
14*	4530 N. 17th Avenue, Phoenix
15*	2035 North 52nd Street - Scottsdale
16*	600 North 40th Street - Phoenix
17*	27th Avenue/Grand/Thomas - Phoenix
18*	10005 E. Osborn - Scottsdale
19*	3905 N. 7th Avenue, Phoenix

* State operated

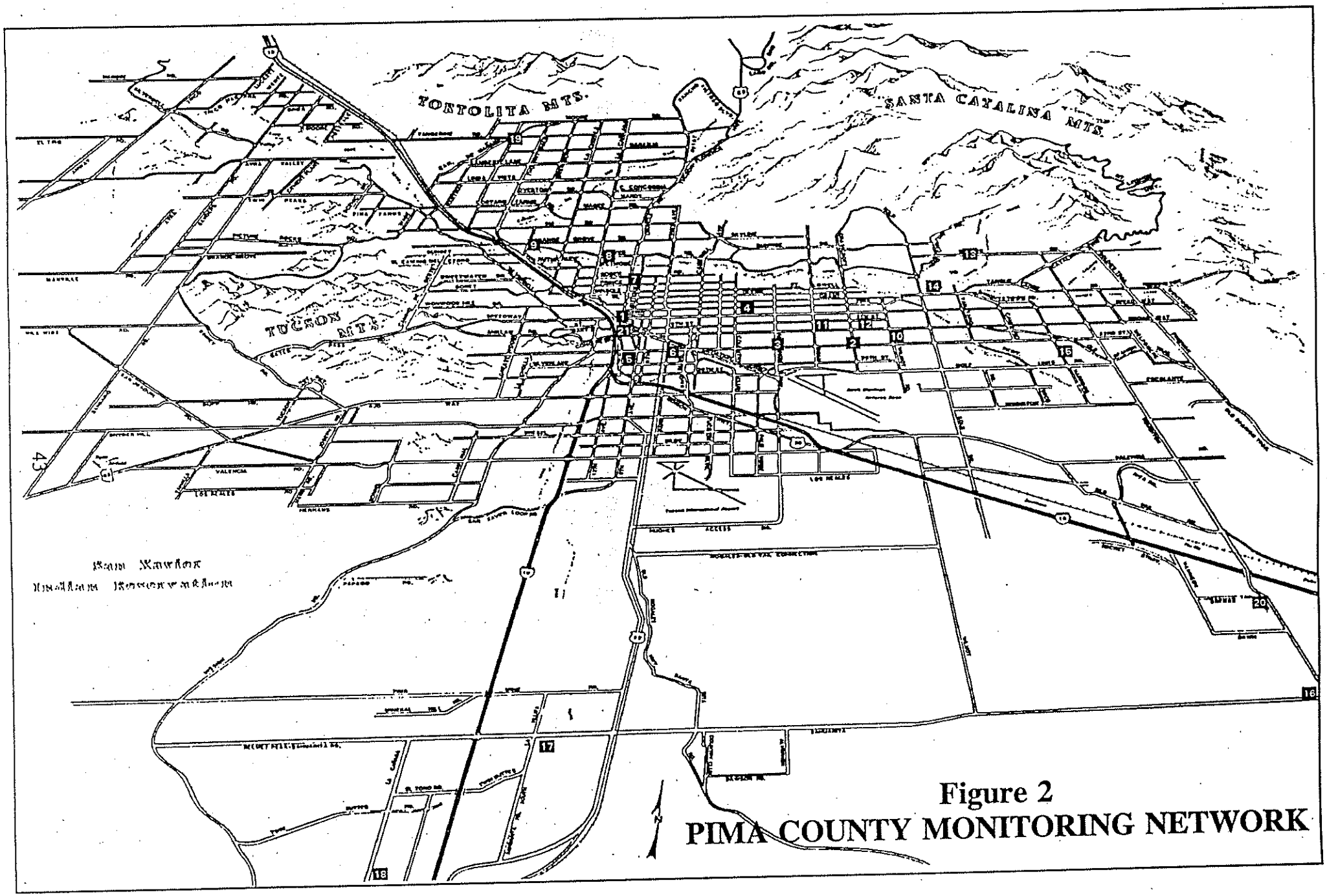


Figure 2
PIMA COUNTY MONITORING NETWORK

Map Key for Figure 2

Pima County Monitoring Network

Map Number	Site
1	190 West Pennington
2	22nd & Craycroft
3	22nd & Alvernon
4	2745 North Cherry
5	1810 South 6th Avenue - South Tucson
6	2nd Street & Palm
7	1016 West Prince
8	4591 North Pomona
9	3401 West Orange Grove
10	346 North Cloverland - Highland Park
11	2645 East Broadway
12	Broadway & Craycroft
13	4829 North Sabino Canyon
14	7290 East Tanque Verde
15	2181 South Harrison
16	22000 South Houghton - Corona de Tucson
17	350 West Helmet Peak - Sahuarita Jr. High School
18	241 West Esperanza - Green Valley
19	12101 North Camino de Oeste - Tangerine
20	11330 South Houghton Rd. Pima County Fair Grounds
21	260 South Church - Community Center

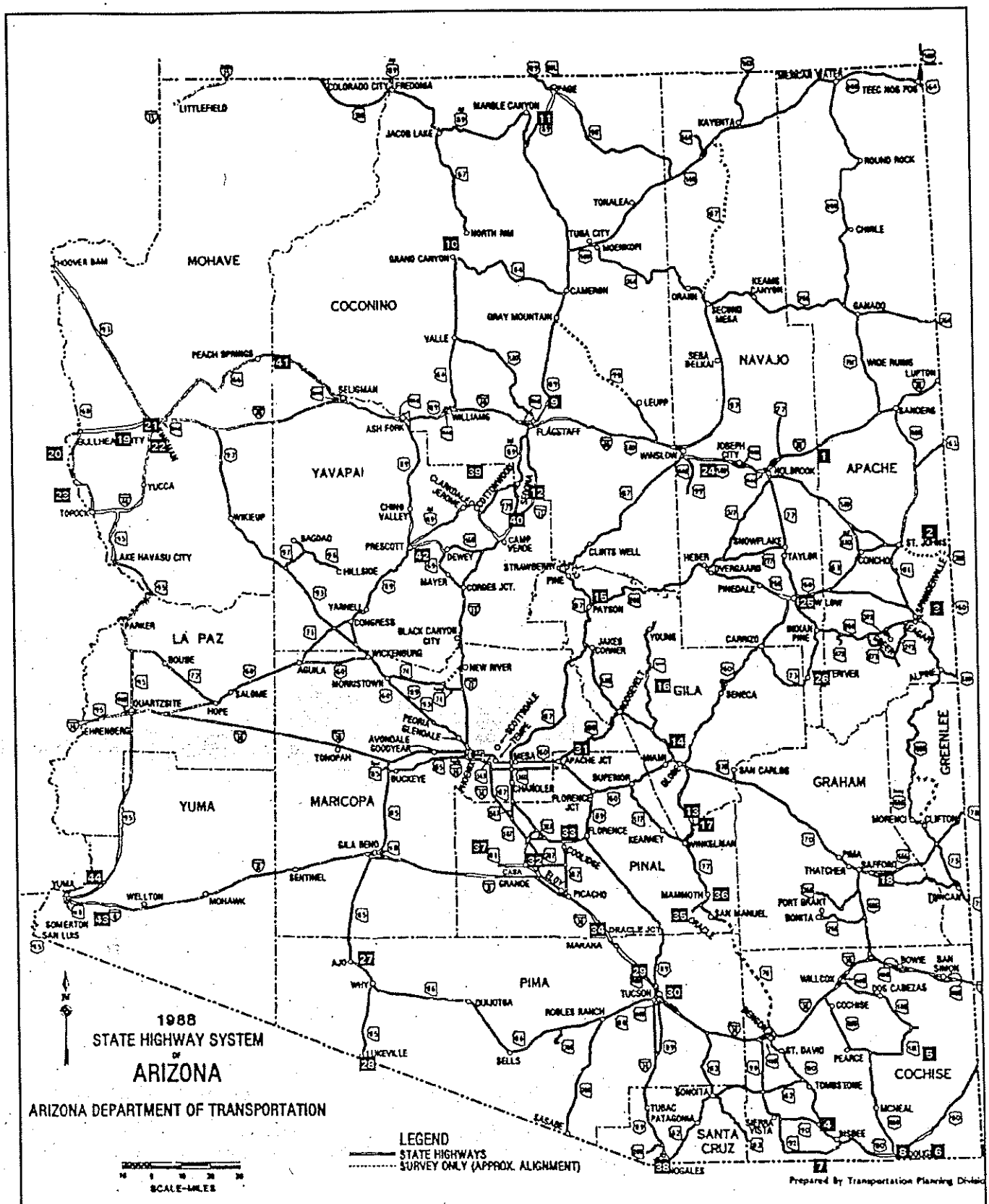


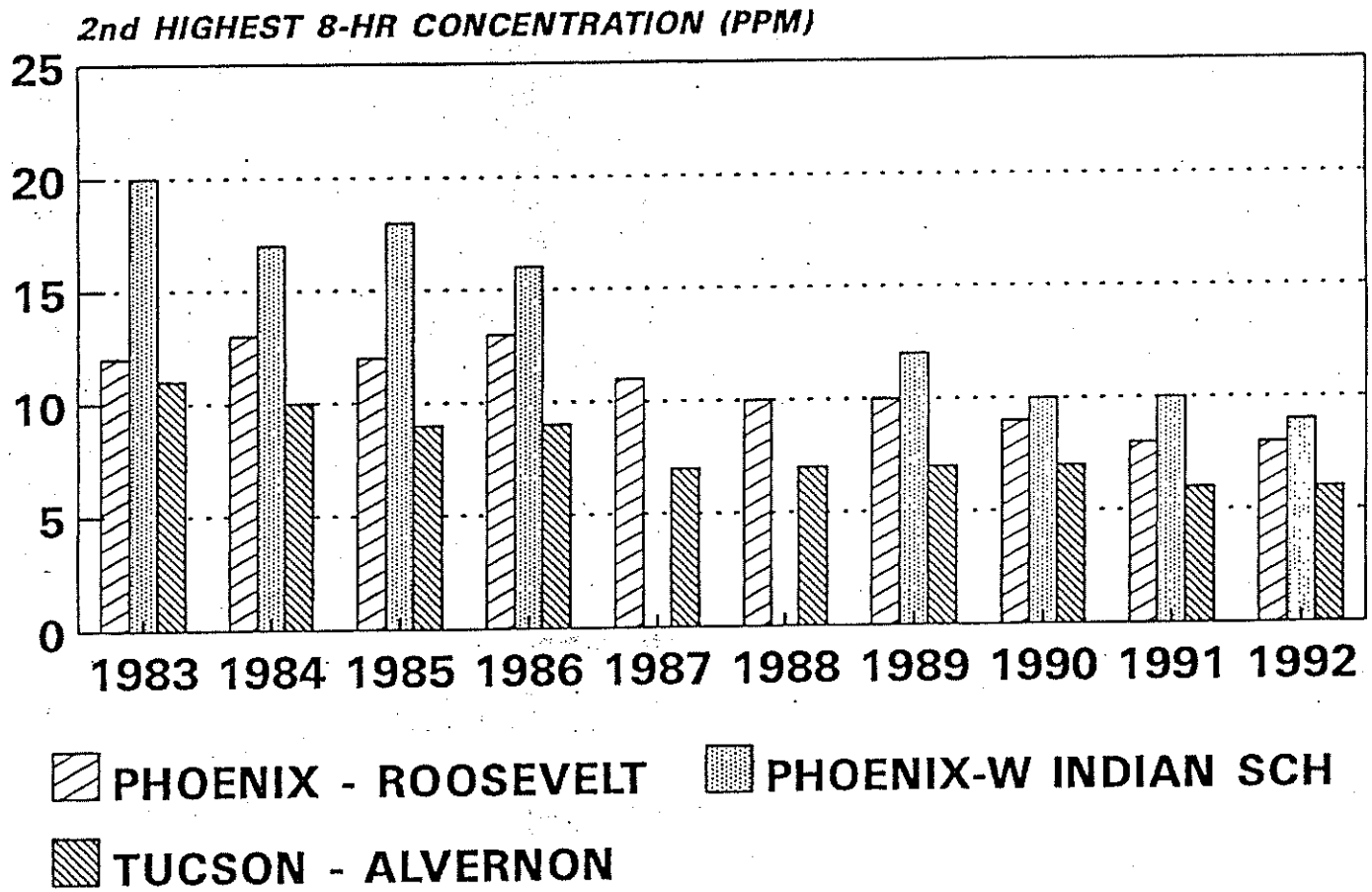
Figure 3
STATE, COUNTY & INDUSTRIAL MONITORING NETWORK

Map Key for Figure 3

State, County and Industrial Monitoring Networks

Map Number	County	Town
1	Apache	Petrified Forest
2		St. Johns
3		Springerville
4	Cochise	Bisbee Junction
5		Chiricahua
6		Douglas
7		Naco
8		Paul Spur
9	Coconino	Flagstaff
10		Grand Canyon
11		Page
12		Sedona
13	Gila	Hayden
14		Miami
15		Payson
16		Tonto
17		Winkelman
18	Graham	Safford
19	Mohave	Bullhead City
20		Holiday Shores
21		Kingman
22		McConnico
23		Riviera
24	Navajo	Joseph City
25		Show Low
26		Whiteriver
27	Pima	Ajo
28		Organ Pipe
29		Rillito
30		Saguaro N.M.
31	Pinal	Apache Junction
32		Casa Grande
33		Coolidge
34		Marana
35		Oracle
36		San Manuel
37		Stanfield
38	Santa Cruz	Nogales
39	Yavapai	Clarkdale
40		Montezuma Castle
41		Nelson
42		Prescott
43	Yuma	Somerton
44		Yuma

FIGURE 4
CARBON MONOXIDE CONCENTRATIONS IN PHOENIX AND TUCSON



STANDARD IS 9 PPM

FIGURE 5
CARBON MONOXIDE EXCEEDANCES IN PHOENIX AND TUCSON

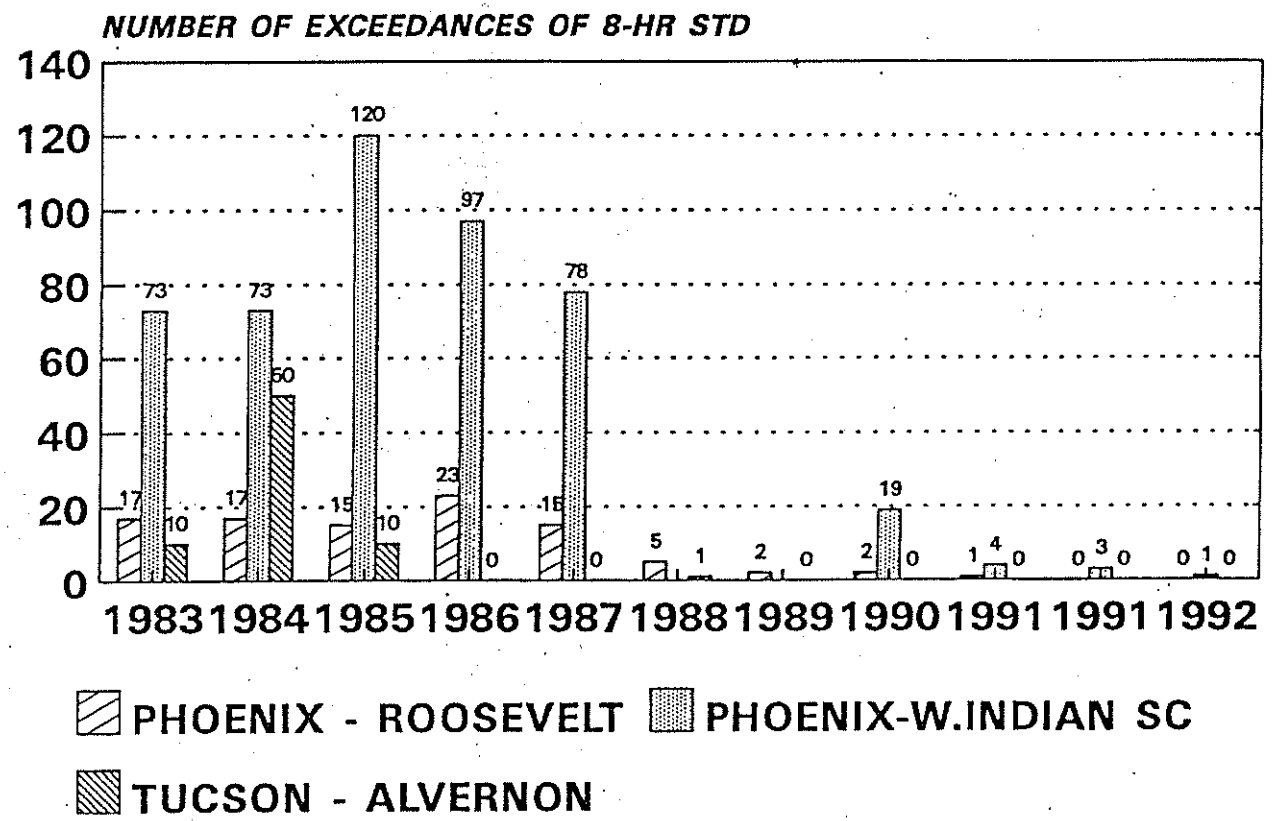
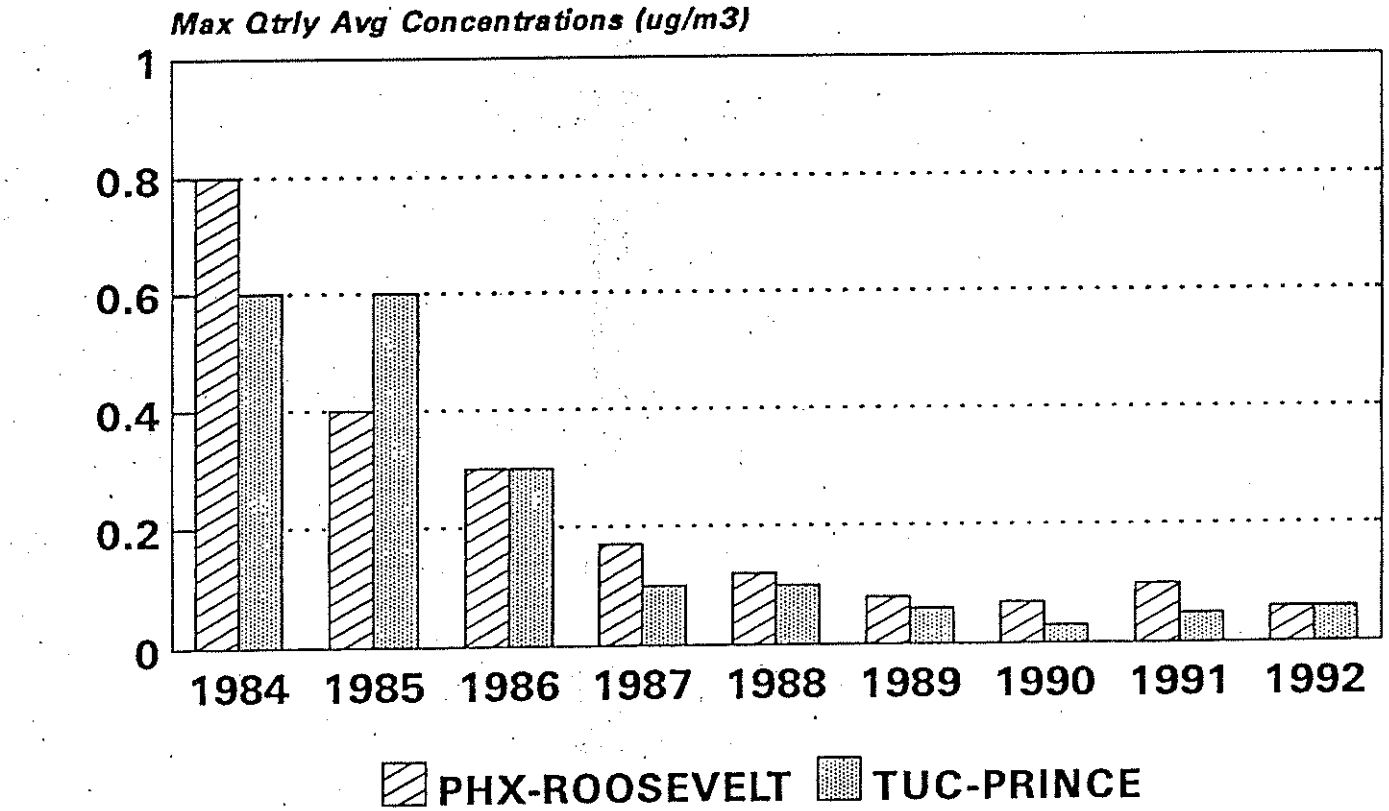
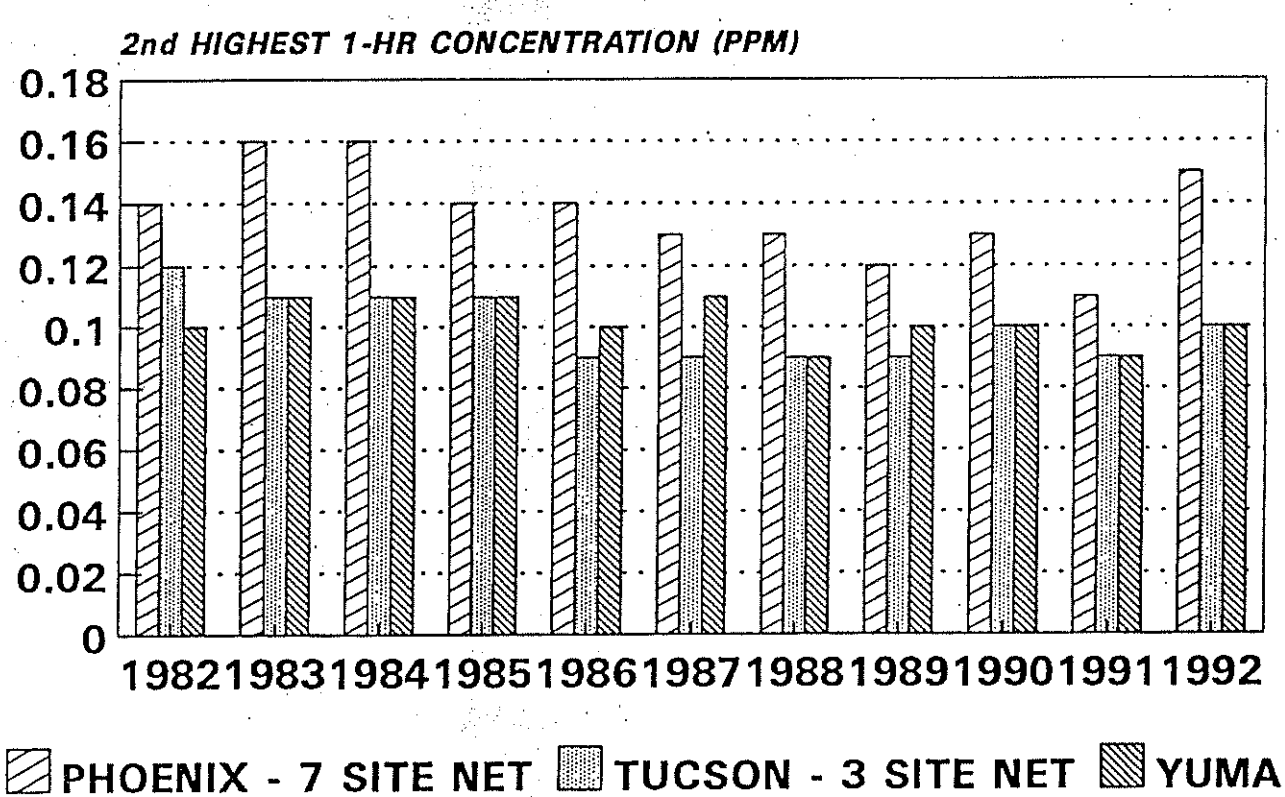


FIGURE 6
LEAD CONCENTRATIONS
IN PHOENIX AND TUCSON



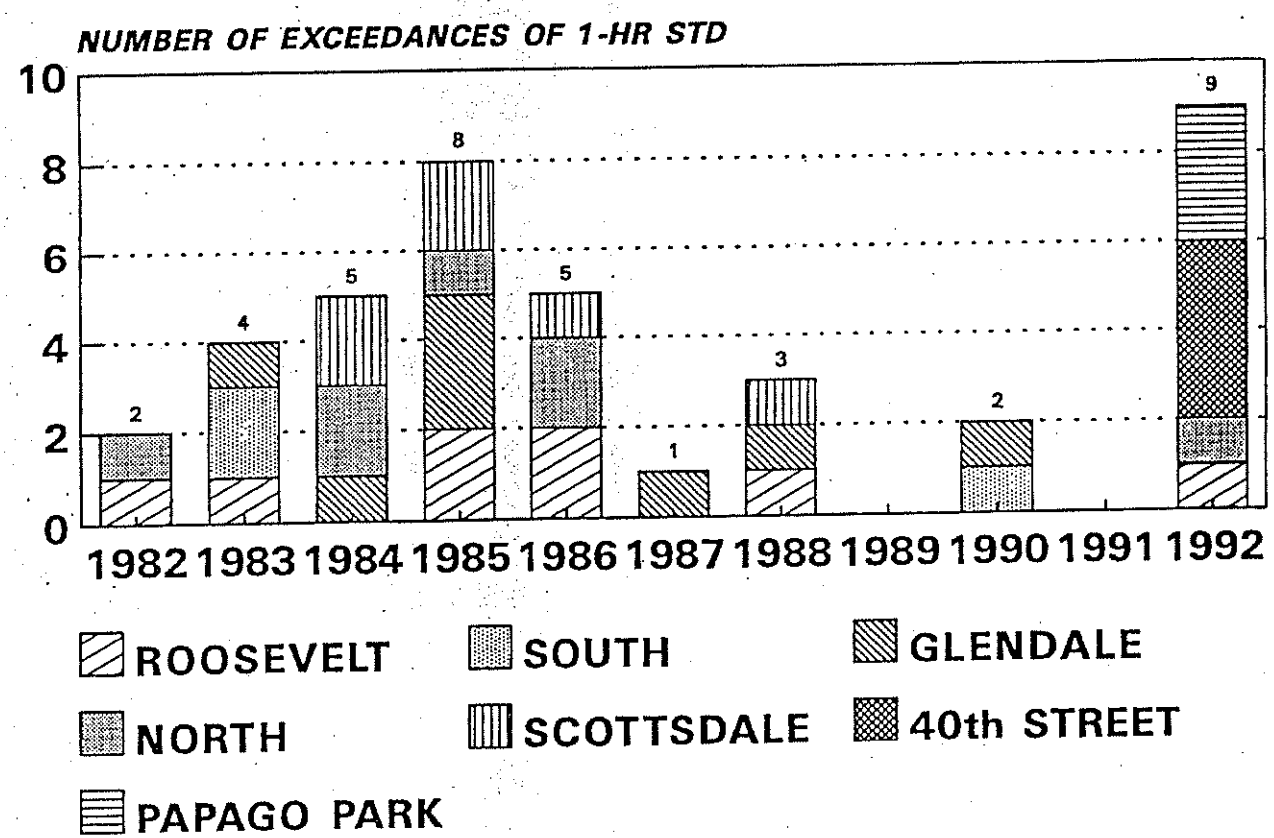
Standard is 1.5 (ug/m3)

FIGURE 7
OZONE CONCENTRATIONS
IN PHOENIX, TUCSON AND YUMA



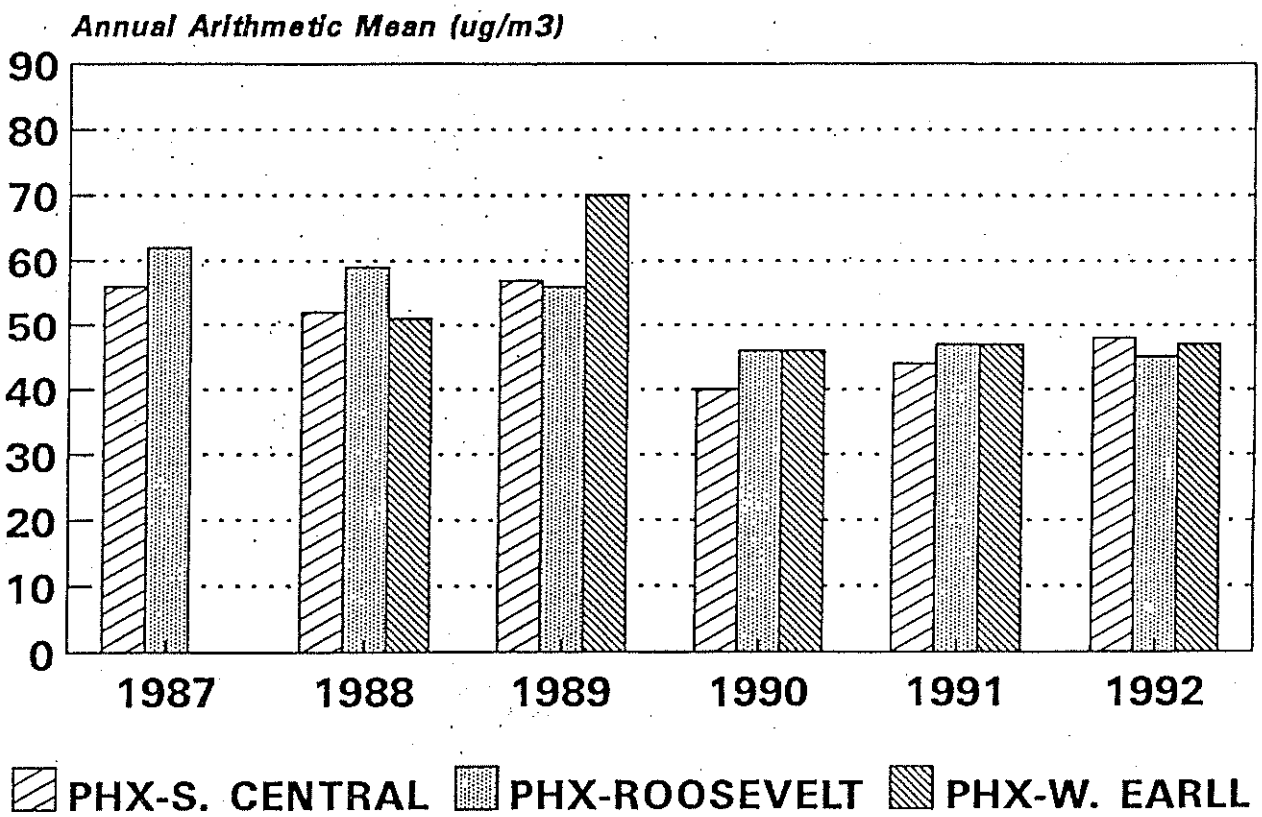
STANDARD IS .12 PPM
1991 - 1992 two new sites added

FIGURE 8
OZONE EXCEEDANCES
FOR PHOENIX 7 SITE NETWORK



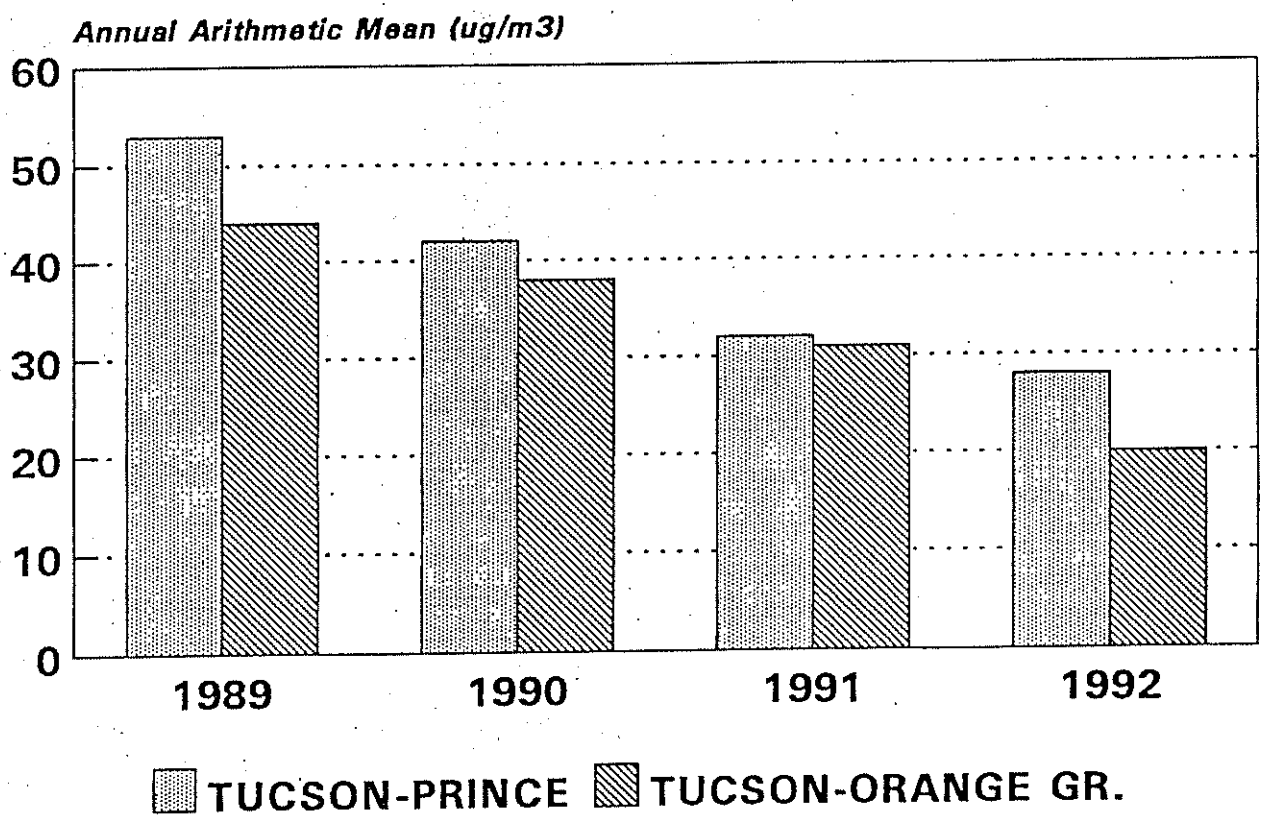
STANDARD IS .12 PPM

FIGURE 9
PM10 CONCENTRATIONS IN PHOENIX



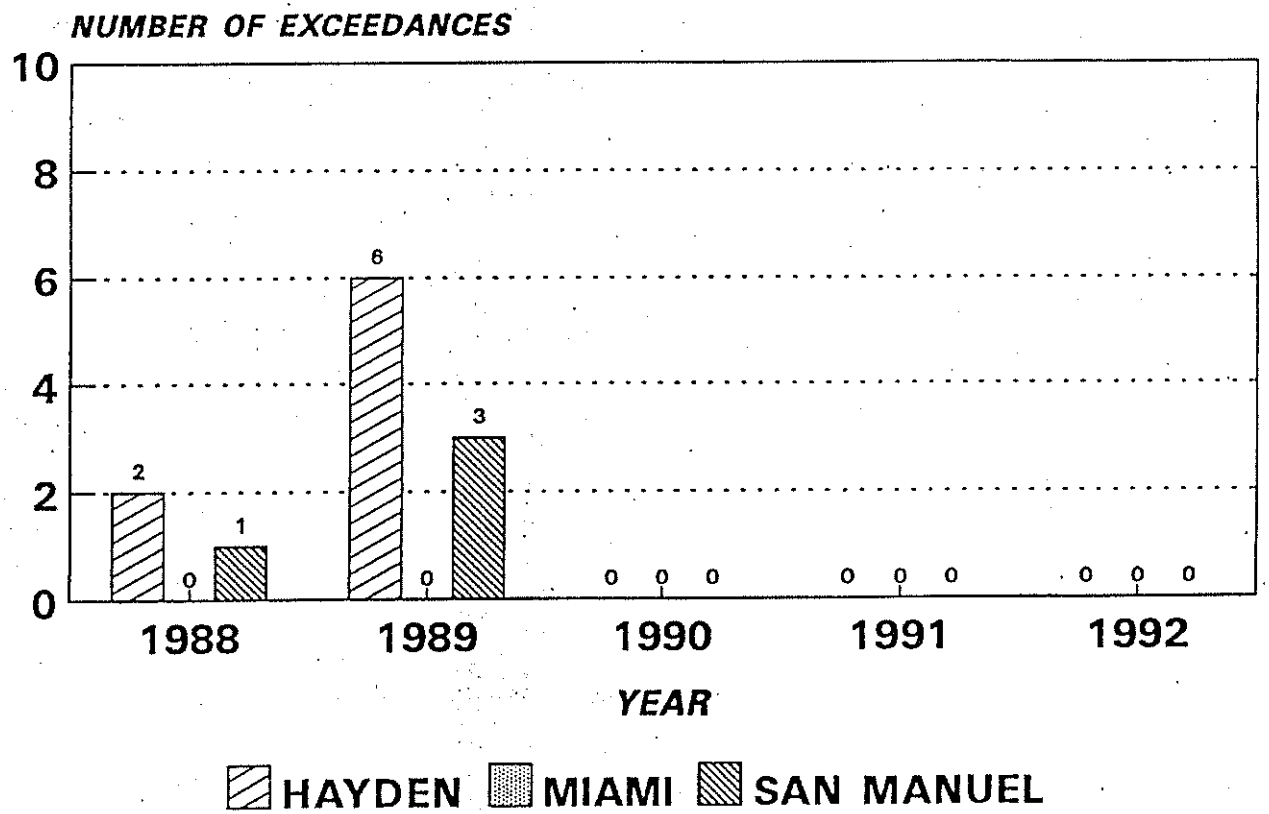
Standard is 50 (ug/m3)

FIGURE 10
PM10 CONCENTRATIONS IN TUCSON



Standard is 50 (ug/m3)

FIGURE 11
SULFUR DIOXIDE 3 - HR EXCEEDANCES IN SMELTER TOWNS



Air Quality Standard is 1300 ug/m3 (3hr)